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THE CULTIVATION AND WEAVING OF COTTON IN THE PREHISTORIC SOUTHWESTERN UNITED STATES

KATE PECK KENT

University of Denver

Drawings by Frances R. Reynolds and Malcolm Withers

THE AMERICAN PHILOSOPHICAL SOCIETY

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NOVEMBER, 1957

In Memory of

FREDERIC H. DOUGLAS

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PREFACE

The foundations of this study were laid in 1937 when the National Park Service sent their collection of cotton textile fragments from Montezuma Castle National Monument to the Indian Department of the Denver Art Museum for analysis. These were turned over to me, and in the course of studying them I realized how little information on prehistoric weave processes and on the importance of cotton in the life of the pre-Spanish Southwestern Indians had found its way into print. It seemed to me this gap in the archaeological record should be filled, in so far as possible. With this in mind, during the next few years whenever the opportunity presented itself, I visited museums, making a study of the cotton fabrics in their collections. Two grants from Dr. F. H. Douglas of the Denver Art Museum, from 1945 to 1947, enabled me to complete these records and begin the task of getting them into manuscript form. At this time, also through the kindness of Dr. Douglas, Miss Frances Raynolds commenced work on the excellent series of line drawings which supplement and clarify the text. Her help was invaluable, and she deserves full credit for devising the illustrative means of making complex weave techniques intelligible to the reader. Thirty-seven of the plates are entirely or largely hers.

The project was virtually shelved from 1947 until 1952 when a grant from the American Philosophical Society made it possible to resume work. At this time Miss Raynolds was unable to continue the drawings, and her place was filled by Mrs. Malcolm Withers who completed the series together with the outline maps.

Textile material from the following collections has been analyzed: American Museum of Natural History, Amerind Foundation, Arizona State Museum, Brooklyn Museum, Colorado State Historical Society, Museum of the American Indian, Museum of Northern Arizona, Museum of New Mexico, National Park Service collections from Aztec, Mesa Verde, Montezuma Castle, and Tonto Monuments, Peabody Museum at Cambridge, University of Colorado Museum, University Museum at Philadelphia, University of Utah, and the United States National Museum.

I wish to thank staff members of all these institutions for their cooperation in making the material readily available to me. Special thanks are due to Miss Bella Weitzner at the American Museum of Natural History, Dr. Emil W. Haury and Mr. E. B. Sayles at the Arizona State Museum, Miss Katharine Bartlett and Dr. H. S. Colton at the Museum of Northern Arizona, Mr. Charlie R. Steen and Mr. Dale King of the National Park Service, Dr. J. O. Brew, Dr. Donald Scott, Dr. Watson Smith and Miss Isabel Guernsey at the Peabody Museum in Cambridge, Mr. Herbert Krieger at the United States National Museum, and Miss H. Newell Wardle at the University Museum in Philadelphia. The late Mr. Earl Morris generously granted permission for the study of textile material from Canyon de Chelly.

Mr. Robert Burgh and Mr. Arthur Kent furnished helpful suggestions on the organization and writing of the text. Advice on textile terminology was given me by Miss Irene Emery, and Mr. Keith A. Dixon and Miss Elaine Bluhm kindly turned over to me their excellent notes on the diamond twill from Tularosa Cave. The final preparation of the manuscript and drawings was greatly facilitated through the use of office space generously allotted me by Mr. Arnold Withers at the University of Denver. I am indebted to Dr. Haury and Dr. Douglas for critical reading of the manuscript.

The financial assistance of Dr. Douglas and the American Philosophical Society, without which this work would not have been completed, is deeply appreciated and gratefully acknowledged.

ABBREVIATIONS USED FOR INSTITUTIONS AND COLLECTIONS

AF. Amerind Foundation. Dragoon, Arizona.
AMNH. American Museum of Natural History. New York, New York.
ASM. Arizona State Museum. Tucson, Arizona.
BM. Brooklyn Museum. Brooklyn, New York.
CSHS. Colorado State Historical Society. Denver, Colorado.
CU. University of Colorado. Boulder, Colorado.
GP. Gila Pueblo. Globe, Arizona.
LA. Laboratory of Anthropology. Santa Fe, New Mexico.
MAI. Museum of the American Indian. New York, New York.
MNA. Museum of Northern Arizona. Flagstaff, Arizona.
NMSM. New Mexico State Museum. Santa Fe, New Mexico.
NPS–AM. National Park Service collection from Aztec Monument, New Mexico.
NPS–MC. National Park Service collection from Montezuma Castle, Arizona.
NPS–T. National Park Service collection from Tonto Monument, Arizona.
PM. Peabody Museum. Cambridge, Massachusetts.
UM. University Museum. Philadelphia, Pennsylvania.
UU. University of Utah. Salt Lake City, Utah.
USNM. United States National Museum. Washington, D. C.

THE FIGURES

The following types of zip-a-tone are used, with certain exceptions, to denote shading and colors in the line

drawings:

No. 22. Yellow.
No. 36. Blue.
No. 52. Black.
No. 54. Brown.
No. 64. Shading.
No. 85. Red.

A few drawings, done early in the project, are shaded by hand. Included are figures: 35; 42, A, 1; 47, C, 2; 70; 76, A, 2–4 and B, 2; 90, A–E; 97, A; 98, G; 105, A, C–F; and 117. This is true also of most of the drawings in figures 137–141, which will be found in Chapter VII, Notes on Textile Design. Shading on weft-wrap openwork drawings does not relate to the key given above.

THE CULTIVATION AND WEAVING OF COTTON IN THE PREHISTORIC SOUTHWESTERN UNITED STATES

KATE PECK KENT

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INTRODUCTION

A GENERAL STATEMENT OF THE PROBLEM

There are four known areas in the world where perishable textile material, preserved by excessively dry conditions, has survived in appreciable amounts to the present day. These are Inner Mongolia and Egypt in the Old World, and coastal Peru and the Southwest in the New World. We are concerned here with finds from the last-named region. By "Southwest" we mean the area defined by archaeologists as including Arizona and New Mexico with adjacent parts of Mexico, southwestern Colorado and southern Utah west to the Moapa Valley in southern Nevada. The word "textile" is understood to mean cloth woven from spun fibers. It does not include baskets, mats, and certain other articles fashioned from vegetable fibers. Sandals, even those woven from spun thread, are not included. Essentially, the interest lies in cloth woven on a loom with heddles. Since loom weaving in the pre-Spanish Southwest correlates with the use of *cotton* thread, the basis of our study is an analysis of archaeological cottons.

The heart of the paper consists of detailed descriptions of the processes used in weaving various types of cotton fabrics—a thread-by-thread account of each technique. An attempt is also made to explain the origin, growth, and recent decline of the cotton-and-loom complex within the Southwest, and to demonstrate its importance in the life of the aboriginal people. The relationship of weaving in this area to that in centers of high culture in Mexico, Central America, and Peru is also explored to some degree.

THE MAJOR SOURCES OF TEXTILE MATERIAL

Although there are isolated finds of cotton and related forms of evidence by means of which the record

for loom weaving may be pushed back in the Southwest to A.D. 700 or earlier, the material with which we are dealing comes principally from sites dating between 1000 and 1400. Much of it was found in northeastern Arizona and adjacent parts of Utah, Colorado, and New Mexico in cliff dwellings of the period between 1100 and 1300. This includes villages at Mesa Verde, White House, Kiet Siel, Painted Cave, and many other ruins in the San Juan drainage. Some material survived in the dry inner rooms of large Pueblo towns built in the open, such as Wupatki, Aztec, Pueblo Bonito, and Chetro Ketl. There are good collections also from settlements of somewhat later date (1200–1400) along the Mogollon Rim in central and east central Arizona, notably Montezuma Castle, Canyon Creek, Hidden House, and Tonto Monument.

Cotton material from caves of southwestern New Mexico is limited, and for the most part poorly dated, although believed to represent weaving in that area, especially between about 1000 and 1200. As might be expected, finds are least satisfactory in the desert regions of southern Arizona, where villages were built in the open. The best source is Ventana Cave, and this is supplemented by a few scattered finds from other sites.

It must be emphasized that the years 1000 to 1400 do not necessarily delimit the Golden Age of weaving, nor should we assume from the distribution of the finds that the Pueblo people of northern and central Arizona were more skilled in the textile arts than those of southwestern New Mexico, or than their neighbors of the southern Arizona desert. It simply happens that during those four centuries the people, especially in the central and northern parts of the Southwest, were using dry caves as village sites and for the burial of the dead. Conditions at that time in those places were particularly favorable for the preservation of perishable goods, and large amounts of cotton survived.

Nearly a thousand pieces of cloth from at least 114 sites have been examined. Most are in the form of fragments torn from larger articles, but there are a good number of complete, or nearly-complete, fabrics—enough so that we can easily tell the uses that were made of cotton thread.

Many specimens were found in trash mounds, in the fill of abandoned living rooms, or (in the south) in the debris on the floor of caves which had served as religious shrines. The most spectacular finds, however, and those embracing whole cloths, were associated with burials. Throughout the Pueblo area it was the custom to inter the dead wrapped in blankets, and often with other articles of clothing on or about them. Sometimes weaving and spinning tools, cotton yarn, seed, or cloth bags also accompanied the body. It is from finds of this nature that we have acquired most of our knowledge of prehistoric weaving. There are good descriptions and illustrations of burials in the literature on Ventana Cave, Painted Cave, Canyon Creek, and several other sites. (See Bibliography.)

A very few pieces of cloth have been preserved by means other than excessive dryness. Thus charring accounted for the survival of significant scraps from Snaketown and Kinnikinnick, and contact with minerals saved fragments from the Moapa Valley, Verde Valley, and Los Guanacos. A list of sites yielding cotton and other evidences of loom weaving will be found in Appendix B, chart 1, with their location shown on the accompanying map, Number 13 (p. 661). The material studied rests in the collections of the several institutions named in the Preface.

THE DATING OF TEXTILE MATERIAL

The only safe way of dating textile material is on the basis of the imperishable goods associated with it. That is, the age of the textile should be presumed to be the same as that of the site, or the particular part of the site, from which it came, as reckoned through tree-rings, pottery, architecture, and so on. It would be quite impossible, with the knowledge presently at hand, to determine, on the basis of its appearance alone, whether a piece of cotton cloth were woven in Pueblo I, II, III, or IV times. That is, the few existing examples of cloth from sites known to date to the first two horizons show the same skill in spinning thread and the same proficiency in weaving that appear in fabrics from later periods. We have not, and may never have, sufficient amounts of cloth from the years between 700 and 1000 to define in other than theoretical terms the range of techniques, designs, and other characteristics which probably distinguished it from material woven in more recent years.

Fortunately, several key collections have been accurately dated. There is much material, however, from unknown sources or from sites for which excavation records are lacking or poor, or stratification impossible to determine. This is usually assigned in museum catalogues or excavation reports to Pueblo horizons, and more particularly to the period between 1100 and 1300, since it is generally assumed that pre-Pueblo people did not have cotton, and that weaving reached its peak in Pueblo III times. These assumptions are open to some question, and dating done in this manner should be accepted only with reservation.

Since we have not sufficient knowledge to state which of a number of fabrics in a given site were woven locally and which may have been acquired through trade, it has seemed reasonable to accept each as the product of the village in which it was found. The possibility of trade, however, is frequently stressed in the text.

SUPPLEMENTARY FORMS OF EVIDENCE

In addition to actual specimens of thread and woven cloth, there are other forms of evidence which, appearing at a given site, indicate a knowledge of cotton and loom weaving. These include cotton seed, lint and plant

parts, cotton seed beaters, spindle whorls and shafts, loom parts, weaving tools, and textile imprints in clay. Extremely important, too, are the pictorial representations of human figures wearing woven clothing in the Jeddito and Kuaua murals and on some Mimbres pottery. The achaeological record ends about 1500, although there is some textile material of the early historic period from Awatovi and a few disappointing scraps from Hawikuh and Unshagi. For a knowledge of weaving between 1550 and 1850 we must depend on interesting but generally inadequate descriptions by Spanish and other early explorers and settlers. The last hundred years of the industry are fairly well documented in anthropological literature and museum collections. All these supplementary materials, significant aids in rounding out the picture of prehistoric weaving, and relating it to that of contemporary Southwestern Indians, are dealt with fully in the text.

RELATED RESEARCHES IN WEAVING

There are some excellent descriptions of prehistoric cotton textiles in archaeological reports. The most detailed are to be found in Haury's publications on Painted Cave, Canyon Creek and Los Muertos, Tanner's account in the Ventana Cave report, and Cosgrove's monograph on the Upper Gila and Mimbres sites. Good accounts of perishable material from the Kayenta area are given by Kidder and Guernsey. Single significant specimens from Snaketown and Tularosa Cave have also been published. These and a number of other references to prehistoric cottons are listed in the Bibliography.[1] In 1937 when this study was launched with the analysis of the Montezuma Castle collection, most of them had not appeared. Haury's Canyon Creek report, with its accurate description and naming of the unique Southwestern technique, weft-wrap openwork, proved to be the most valuable reference, followed closely by Kidder and Guernsey's works. Some good comparative data were also found in Hough's account of Bear Creek and Tularosa Cave textiles, in spite of certain technical errors in his analyses. Jones' summary of the data on aboriginal Southwestern cotton, published in 1936, was also extremely helpful.[2]

Valuable for information on textile terminology, technical analyses and comparative data were O'Neale's reports on prehistoric weaving in Peru and Chihuahua, and her account of contemporary Highland Guatemala fabrics. The story of Pueblo weaving was traced to modern times through the works of Douglas and Mera.[3]

Some of the textile research done by other investigators has not been published, but was made available to me and proved extremely helpful. This includes Dorothea Kelly's manuscript on the McEuen Cave cottons, Marcelotte Leake's analysis of textile finds at Awatovi, Haury's records of textiles from the Sacred Cenote at Chichén Itzá, and the excellent notes of Keith Dixon and Elaine Bluhm on the Tularosa Cave diamond twill tapestry (pp. 544–545).

With very few exceptions it has been possible for me to make an independent analysis of the material presented in these publications and manuscripts. These findings were combined with my records of hitherto undescribed fabrics resting in museum collections, and in this way the entire body of prehistoric cotton textiles was considered as a whole, and all the examples classified and described according to a single scheme. Certain factors which could not be clear to the students of one or another particular village on the basis of what they found locally were clarified by the study of related material from other sites.

PROBLEMS ENCOUNTERED IN ANALYZING WEAVES

The problems that had to be dealt with in order to understand and describe the various processes used in manufacturing cotton fabrics grouped themselves under three headings. First, it was necessary to reconstruct prehistoric weaving devices; second, to discover how these might have been used; and third, to classify and describe the weave techniques according to some orderly and understandable system.

Since interest originally centered on loom-woven cloth, the first step undertaken was the reconstruction of the pre-Spanish loom or looms on which it was woven. There was good archaeological evidence in the Pueblo area of an upright loom such as that used by Pueblo and Navaho today, and certain facts suggested the presence also of the belt loom both there and in central and southern Arizona. The weaving methods and textile goods associated with these machines historically in the Southwest were therefore thoroughly investigated. This was done by familiarizing myself with modern Indian fabrics, by observing native weavers at work, and by studying the publications of Douglas, Reichard, Amsden, Spier, and others.

Armed with this general knowledge, I set about recording and analyzing the Montezuma Castle series, and later, as opportunity presented itself, other known collections. The following information was taken for each fragment or whole cloth: catalogue number; site name, location, and date, if known; any pertinent information on the condition of the find; type of warp and weft thread;[4] over-all dimensions; thread count;[5] sel-

[1] Cosgrove, 1947; Gladwin *et al.*, 1937; Guernsey, 1931; Guernsey and Kidder, 1921; Haury, 1934, 1945*a*, 1945*b*; Haury *et al.*, 1950; Kidder and Guernsey, 1919; Martin *et al.*, 1952. Dixon's report on Hidden House, published after this monograph was in press, is included in the Bibliography, but not referred to in the text.

[2] Hough, 1914; Jones, 1936.

[3] See Bibliography: Douglas, 1930–40; Mera, 1943; O'Neale, 1937, 1942, 1945, 1948; O'Neale and Clark, 1948; O'Neale and Kroeber, 1930.

[4] The direction of twist in spinning and plying was not recorded for the first two or three series studied.

[5] This means the number of warps (or wefts) to the unit of measurement, in this publication, one inch.

vage construction; color or colors;[6] and weave technique.

A sample of fibers from each of the Montezuma Castle and Tonto Monument specimens was sent for botanical analysis to Dr. A. C. Whitford. This was not feasible for the other collections, so only the pieces which appeared to me to contain fibers other than cotton were tested.

Obviously, each piece did not represent a new technique, but fell into a class, such as plain weave, plain tapestry weave, diamond twill, and so forth. Many of these processes are, of course, common to loom weaving the world over, since there are a limited number of ways in which stationary warps, crossed at right angles by pliable wefts, can be combined. Once the basic categories were understood it was not too difficult to catalogue most fragments as belonging to one or another of them. However, there proved to be some unusual weaves, as well as an almost endless number of technical variations and tricks which deserved detailed recording. This was done by sketching each new feature, thread for thread. These crude sketches were reworked as time permitted, and furnished the raw material from which the line drawings in this publication were made.

The techniques were also duplicated on a model loom having the essential features of a contemporary Pueblo vertical loom. This was done by using cotton string —generally parcel post string—for warps, and either the same material, or various colors of carpet yarn, for wefts. These experiments pointed up the technical difficulties which confronted the original weavers, and helped towards an understanding of how certain problems were solved. Hours—sometimes actually days—were consumed in rigging the heddles and working out the processes which might have been used in weaving one small fragment. In spite of the tediousness and the time-consuming nature of this approach, I think it is the essential step in a study of this kind.

The procedure in working out non-loom weaves had to be slightly different from that just outlined for the loom-woven material. There are no remains identifiable as weaving frames, and the only non-loom fabrics made today by the Puebloans are the wide, braided "rain" sashes and some crocheted and knitted articles. Since the last two techniques are European introductions, they were of no help in our studies. An impression of various methods that might have been used in the Southwest was gained by reading widely about native textile techniques all over the world. With this knowledge to draw on, and with the clues to their manufacture inherent in the specimens themselves, I simply sat down and tried to duplicate the weaves by one means or another. As pointed out in the text (see, for example, pp. 579–583) some of the pieces may be reproduced in several different ways, and the one I found most logical may actually not have been that used prehistorically. At any rate, an explanation for almost every piece was found, and the reader may judge their value for himself.

Having analyzed the various techniques, there came the problem of classifying them according to some logical system which would not only be compatible with the terminology used for hand loom fabrics outside our very limited region, but would also be clear to Southwestern anthropologists who were unfamiliar with the technicalities of the subject but might find themselves faced at some time with describing textile finds. This was no easy task, as a confusing welter of terms, some highly imaginative, has been amassed over the years by hand loom weavers and anthropologists alike. The publications of Reath and O'Neale [7] proved very helpful in this respect. Miss Irene Emery, who is engaged in working out just such a terminology, checked the manuscript when it was almost finished and suggested some changes. I have tried to make my classifications agree with her ideas, in so far as I know them, since her work should surely become standard when it is published.

THE ORGANIZATION OF THE PAPER

The first four chapters deal with the cotton plant, spinning, dyes, looms, loom tools, and weaving frames. Weave techniques are then presented, as nearly as possible on a graduated scale from simple to complex, and grouped under three headings: loom-woven cloth and certain closely associated techniques; non-loom fabrics having warps and wefts; and fabrics made up of single elements. The plan has been to define and describe each weave, to show the various ways in which it could be modified and what types of articles were woven by it, and to give its distribution so far as it is presently known. Following this there is a statement, sometimes quite theoretical in nature, of its possible relationship to pre-loom Basketmaker fabrics, post-Spanish Pueblo Indian cloth and processes used in Mexico, Guatemala, and Peru. The chapter on weave techniques is followed by one summarizing the various uses made of cotton fiber and cloth. A brief statement on the characteristics of textile design is then given, and the final chapter summarizes the various regional and temporal developments in Southwestern weaving from the time of Christ until today.

NOTES ON THE DATING SYSTEM AND TERMINOLOGY USED IN THE TEXT

In relating textile finds to Southwestern prehistory as a whole the best approach seemed to be to avoid the use of technical terminology in so far as possible. However, there had to be a framework within which to work, and the résumé of cultures presented by Reed [8] was adopted as being a simple and reasonable explana-

[6] Colors have been matched against Maerz and Paul's *Dictionary of color*, 1950.

[7] O'Neale and Clark, 1948. O'Neale, 1937, 1942, 1945, 1948. Reath, 1927.

[8] Reed, 1950, 1951.

tion of the inter-relationship of prehistoric groups. The basic concepts are as follows:

The general term "Pueblo" is understood to apply to the people of the Colorado Plateau and the Mogollon Rim. The northern division of Puebloan peoples, concentrated in the San Juan from about the time of Christ to 1300, is called Anasazi-Pueblo. The term Anasazi includes both the earlier Basketmaker (?–700) and the Pueblo peoples (700–1300). The northern Rio Grande Pueblos are considered basically Anasazi-Pueblo. The southern division of Puebloans, inhabiting the Mogollon Rim from the vicinity of Flagstaff into southwestern New Mexico, is identified as Mogollon-Pueblo. We are concerned with three major offshoots of Mogollon-Pueblo culture: Sinagua, Salado and "Eastern Mogollon." The culture of the Sinagua people of the Flagstaff area and the Upper Verde between 700 and 1400 is understood to be a blend of Mogollon-Pueblo, Anasazi-Pueblo, Hohokam, and Cohonina. (The last of these does not concern us here.) The term Salado is applied to a people with Mogollon-type pottery who lived in the Middle Salt River Valley between about 1250 and 1400 in close contact with Hohokam and late Sinagua. "Eastern Mogollon" is a term used by me to cover the Mogollon-Pueblo development of cotton weaving as illustrated in material from Tularosa Cave and other sites in southwestern New Mexico from about the time of Christ to 1200 or shortly after. The Hohokam are, of course, the inhabitants of the southern Arizona Desert, from the vicinity of Phoenix south, between at least the time of Christ and 1400.

All dates have been keyed into the system generally used for Anasazi culture periods, that is:

Basketmaker I and II	?– 500
Basketmaker III	500– 700
Pueblo I	700– 900
Pueblo II	900–1100
Pueblo III	1100–1300
Pueblo IV	1300–1550
Pueblo V	1550–present

When other period or phase names are employed they are accompanied by approximate dates. The dating sequence for the Eastern Mogollon is taken from Martin's report on Tularosa Cave.[9] All dates are understood to be Anno Domini unless the letters B.C. are used with them.

AREAS OF RESEARCH THAT HAVE NOT BEEN COVERED IN DETAIL

Several major areas of research have been left wholly or partially unexplored. One of these is the chemical analysis of dyes and paints. This should be undertaken in the manner employed by Michael Kasha for Chihuahua textiles.[10] The remarks on design are intended to be in the nature of preliminary notes. More could be done in comparing Southwestern, Mexican, Mayan, and Peruvian weaving. Probably the most rewarding supplementary study would be the analysis of all known Basketmaker and prehistoric Pueblo fiber and wool textiles undertaken on the same basis as this and including material from areas immediately adjacent to the Southwest such as Chihuahua and Coahuila. This should include intensive fiber analysis. Except in the case of the Montezuma Castle and Tonto material and a few other specimens (as noted in the text), none of the basts referred to in this publication have been subjected to botanical analysis, so far as I know. My designation of some fibers in a piece as yucca and others as apocynum is based on statements to this effect in published reports or museum catalogues. There is every possibility of error. Fiber analysis is a sadly neglected aspect of the textile studies so far undertaken for the Southwest.

[9] Martin *et al.*, 1952.

[10] O'Neale, 1948: 151–157.

I. THE COTTON PLANT

BOTANICAL NOTES

The cotton plant of the Southwestern Indians is not indigenous to New Mexico and Arizona, but represents a pre-Spanish import from northern Mexico. The suggestion that it was developed locally from *Thurberia thespesiodes,* or "Arizona Wild Cotton," must be discarded on the basis of botanical findings. This plant cannot be identified as the parent of any domestic cotton. Except for the statement of one Papago informant, no tradition of utilizing the fibers of *Thurberia* exists among Indians of the Southwest.[1] The only aboriginal species so far reported within the area is *Gossypium hopi.* This was named and described by Lewton in 1912, on the basis of specimens from Hopi gardens at Moenkopi and Oraibi, and from the Pima at Sacaton.[2] Cotton samples gathered in the 1920's and '30's from Indian gardens at Zuni, Santa Ana, Española, and the Havasupai reservation are identified as *Gossypium hopi,* or varieties thereof. This species is generally believed to be the one used prehistorically in the area, although there have been few attempts to prove this true by actual analysis of archaeological material. A study of raw fiber from Canyon Creek[3] and Painted Cave[4] shows the staple length to be approximately the same as existing Hopi cotton (fig. 1). Finds from Gypsum Cave and the Grewe Site are said to be of this species, but the basis for their identification is not given.[5]

Gossypium hopi is described[6] as having the shortest growing period of any cotton on record, bolls ripening in about 84 to 100 days. It can be grown successfully as an annual at quite high altitudes and under very arid conditions. According to Jones, it could have been

[1] Castetter and Bell, 1942: 106.

[2] Lewton, 1912.

[3] Haury, 1934: 87–88 and Haury and Conrad, 1938.

[4] Haury, 1945*b*: 26.

[5] The reader should refer to Jones, 1936, for an excellent summary of data on aboriginal cotton in the Southwest as known at that time.

[6] Jones, 1936: 56–57; Lewton, 1912: 8–10.

FIG. 1. Cotton seeds with fiber, identified as of the same general type as Hopi cotton. The lower print shows staple length, about $\frac{15}{16}$". Painted Cave. (Photo by Amerind Foundation.)

grown in southern Utah and Colorado. The plant is low and spreading. Bolls are divided into four sections, with seven or eight dark brown seeds in each. These seeds are devoid of fuzz with the exception of a few dark hairs on their pointed ends. The fibers range in length from 18 to 20 millimeters, or around $\frac{7}{8}$ inch. Jones states (p. 57): "The lint is . . . distinctive, having the unique combination of fineness of fiber and shortness of staple length." It is precisely this quality that should make possible the identification of archaeological cotton with reasonable accuracy. This is the approach used on the Painted Cave and Canyon Creek material mentioned above.

The relationship of *Gossypium hopi* to other New World cottons is set forth by Hutchinson, Silow, and Stephens in their work on the evolution of gossypium.[7] These authors believe New World cottons resulted from a cross between an American wild species and a domestic cotton from Asia. Their theory is based on a study of chromosome patterns, which shows the New World domesticates to contain 26 pairs of chromosomes: 13 larger ones homologous to Old World cottons, and 13 smaller ones homologous to an American wild gossypium. The cross is thought to have occurred when pre-Polynesian man carried the seeds of his crop plants across the Pacific, from Asia to South America. Here he settled on the fertile river banks of northern Peru. His imported cotton crossed with a local wild species identified by the authors as *G. raimondii*. It is pointed out, as further support of this theory, that the spindle, two-bar loom, and various weave techniques associated with cotton in India are found also in New World weaving centers. The lack of cotton in most of the intervening islands of Oceania is said to be due to the fact that it was choked out by other growth when the lands on which it had been cultivated were deserted by the early colonists.

The plant so originating in northern Peru was spread by man from that center to other parts of South America, to Central America, and back across some of the Pacific Islands, although not as far as Asia. After this initial spread came a long period of isolation which allowed for the development of three distinct species, one in the Hawaiian Islands, one in the northern Peruvian highlands, and one (*Gossypium hirsutum*) in southern Mexico and Guatemala. *Gossypium hopi* is related to the last-named of these. There is a wide variability in range of types of *Gossypium hirsutum* in the region where it developed, some plants being grown as annuals and some as perennials, with white, brown, and rust-colored lints used for weaving patterned cloth. Three varieties have arisen in three geographically and ecologically distinct areas. We need not concern ourselves with the first of these. The second is var. *punctatum*, centering in eastern Mexico and Honduras, and said to be the type used and cultivated by the Mayans. It is a perennial with small bolls and a low ginning output. According to the authors (p. 107): "Cultivated forms include the Hopi cottons formerly utilized by the Indian tribes of the Southwestern United States." Some plant geneticists believe that the remarkable adaptation of a tropical perennial to an annual plant maturing in less than 100 days was accomplished in the highlands of central western Mexico before cotton was spread northward, although close relatives of *Gossypium hopi* have not so far been identified in that area.[8] There is also the possibility that a perennial "Mayan" cotton reached the Hohokam from the west coast of Mexico, and was later adapted to a high altitude and short growing season by the Pueblo peoples of the Colorado Plateau.[9]

The third variety of *Gossypium hirsutum* includes the American Upland cottons. Of these Hutchinson,

[7] Hutchinson, Silow, and Stephens, 1947. The following discussion is taken from Parts II and III, commencing on p. 54. The facts presented were, however, first called to my attention by Dr. Carl O. Sauer in conversations in 1943.

[8] Sauer, conversations, 1943.

[9] Jones, 1936: 57.

Silow, and Stephens say (p. 108): "It may be supposed that their isolation from the variable population of southern Mexico first took place in the Aztec state with the development of agriculture in plateau areas where the climate was unsuitable for the cultivation of perennials." From these botanical facts we may surmise that cotton (and its associate, the loom) originally spread north to Arizona and New Mexico from a Mayan center before the growth of the Aztec empire. Later influences reaching the Southwest from Mexico probably consisted of the introduction of new techniques and design material into a well-established weaving industry.

The pre-Spanish distribution of cotton north of the Mexican border, taking as it does the form of a finger stretching into southern Colorado and Utah, with no comparable extension northeast from Mexico into the Mississippi Valley and the southeastern United States —an area eminently suited to cotton growing—gives rise to the opinion that the plant was carried north through western Mexico. It is in this part of Mexico that loom weaving is important.[10] There is no evidence of the presence of the cotton plant in the "cotton belt" of the United States until after 1600.

THE SPREAD OF THE COTTON PLANT IN THE PREHISTORIC SOUTHWEST

Recent finds in Tularosa Cave indicate that cotton may have reached the Southwest at a very early date, perhaps even before the time of Christ. No loom-woven cloth appears in the Cave until levels dated after 700, but bits of cotton thread are said to have been found in both the Pre-Pottery (300 B.C.–A.D. 1) and Pine Lawn (1–500) Phases, and cotton netting, a cloth-impressed sherd, and specialized pottery spindle whorls (?) in the Georgetown Phase (500–700).[11]

There is no actual proof that cotton was known elsewhere in the Southwest before 700. If we wish to postulate that it was acquired by the Mogollon from the Hohokam, we must place the time of its entry into southern Arizona at A.D. 1 or before, explaining its absence in early Hohokam horizons as the result of its perishable nature. It is fully as plausible to assume that cotton, having been carried north along the high plateaus of western Mexico, reached southwestern New Mexico direct from Chihuahua, and was then relayed to the Hohokam and Anasazi. The lack of cotton in Basketmaker-Anasazi sites seems remarkable if it was in use to the south of them between 1 and 700. There are hints that it might have been present, but no definite evidence (table 1). Examples of cotton cloth which *might* be BM III are poorly documented. If we consider that the plain weave apocynum cloth of BM II was loom woven, and that the loom was acquired with the cotton plant, we can say that the Anasazi had at least a nodding acquaintance with cotton around 300 or 400, although they did not yet have enough of the new fiber to weave with it. This, however, is pure speculation.[12]

Evidence of cotton and loom weaving occurs with increasing frequency after 700 (table 1, p. 468), and by 1100 it had spread to all parts of the Southwest. Cloth said to be of Pueblo manufacture is even reported from a site near Bakersfield, California, indicating that loom products may have been traded to peoples outside the Southwest.[13] The plant may have been valued not only for its spinnable fiber, but for the seed, which, used as a food, would add some vegetable oil to the diet. These properties, together with its light weight, made it a natural article for trade, and probably led to its rapid diffusion throughout the Southwest. While it is not difficult to list the villages where cotton (or the loom) was known to have been *used*, it is almost impossible to ascertain the extent to which it was actually *grown*. Presumably the only dependable criteria of local cultivation would be the presence of plant parts. Since complete cotton bolls may have been traded, the finding of raw fiber and seed in a site is not quite as reliable evidence as plant stalks, although we use it as a guide in the following discussion. Unfortunately, plant stalks are rarely recorded in archaeological reports, possibly because they were not preserved for identification rather than because they were truly absent.

There are indications of cotton cultivation in southern Arizona between 700 and 1100 in the form of cotton seed at the Grewe Site and a mass of matted cotton fibers in the silt of an irrigation canal near Los Muertos. These are believed to have blown into the canal from neighboring fields during a prehistoric harvest.[14] There is no proof that cotton was cultivated north of the Mogollon Rim prior to 1100, although, in my opinion, it is reasonable to suppose that the plant was part of the regular agricultural complex in climatically favorable parts of the Colorado Plateau well before that date. The Pueblo people of 700 were thoroughly familiar with agricultural processes and were adept at spinning and weaving basts and wools. They would have been quick to see the value of the new fiber. Cotton was well suited to their increasingly sedentary way of life, giving them a local source of fiber which they could control, and removing the necessity of gathering all weave materials from nature. Their economy allowed time, too, for the cultivation, ginning, spinning, and weaving of cotton. All in all, conditions were ripe for its acceptance, and it seems unlikely that the people would have depended for long on trade as the sole source of cotton fiber.

The cultivation of cotton in northern New Mexico by Pueblo III is proved by the finding of seed and stalks

[10] Beals, 1932: 106.

[11] Martin *et al.*, 1952. See our table 1, p. 468 for page references.

[12] See Appendix A, p. 658, for a discussion of fiber cloth and its relationship to cotton weaving.

[13] Gifford and Schenck, 1926: 104–105, pl. 2.

[14] Haury, 1945*a*: 163.

TABLE 1

EVIDENCES OF COTTON AND LOOM WEAVING PRIOR TO 1100

Date	Site	Forms of Evidence and Remarks	Source
1100	Chaco Canyon Bc 50–51	Batten (questionable) Cloth	Kluckhohn and Reiter, 1939: 96–97.
	Tseh So	Loom anchor holes (questionable)	Brand *et al.*, 1937: 78.
	Floating House	Cloth	PM
	San Francisco Mountain area	Cloth-impressed sherd, cloth, thread, raw fiber	MNA. Bartlett, 1934: 46–47.
	Snaketown	Cloth	Gladwin *et al.*, 1937: 161–162.
	Tularosa Cave	Cloth and thread	Martin *et al.*, 1952: 299, 351.
900	Bear Ruin	Loom beam depression (?)	Haury, 1940: 45–47.
	Grewe Site	Cotton seed	McGregor, 1941: 155.
	Los Guanacos	Cloth	Haury, 1945*a*: 178–179.
	Tsegi	Cloth	PM. Guernsey, 1931: 2–11, 97–98.
	Tularosa Cave	Cloth and thread	Martin *et al.*, 1952: 299, 351.
700	Broken Roof Cave	Cloth in cist with atlatl and other BM articles. (Listed in files but not found in collections, and not mentioned in Guernsey.)	PM-A5597. Guernsey, 1931: 37–40.
	Deer Track Canyon	Carrying band, all-fiber, weft-twine. End loop reinforced with 2-ply cotton cord.	ASM 19357. Date uncertain. Possibly BM.
	Small ruin near Inscription House	On trash mound. Tapestry cradle band, all cotton. Design has BM "feel."	ASM 2775. Called "Anasazi, 500–700" in files.
	Tularosa Cave	Cloth-impressed sherd, netting, spindle shafts and pottery spindle whorls (?)	Martin *et al.*, 1952: 196, 205–211, 299, 302, 330, 347, 401, figs. 74, 112.
500	Tularosa Cave	Thread	
	Chihuahua	Plain weave fiber cloth, loom-woven?	O'Neale, 1948.
	Tsegi-ot-sosi White Dog Cave	Plain weave fiber cloth, loom-woven?	Guernsey and Kidder, 1921: 63–65.
A.D. 1 300 B.C.	Tularosa Cave	Thread	Martin *et al.*, 1952: 207, fig. 74.

in the Chaco and Aztec districts.[15] Kidder and Guernsey found: "Cotton waste, bunches of fiber, and uncombed cotton still containing seed" in the course of investigations in the Marsh Pass area.[16] Haury collected cotton seed and fiber at Painted Cave[17] (fig. 1). Pepper reported cotton bolls from a site in southeastern Utah,[18] and Nordenskiöld lists raw cotton at Mesa Verde.[19] Hough speaks of "Raw cotton and other seeds accompaning burials" at Kawaika-a.[20] Raw cotton with seed is found in collections from Gourd Cave (ASM), Wupatki and two sites in the Grand Canyon (MNA). Pueblo IV collections from Rogers Cliff Dwelling (MNA), Montezuma Castle and Tonto Monuments (NPS) also contain fiber and seed. In the absence of more definite evidence it is probably safe to assume that an abundance of woven cloth in a site where cotton could have been raised successfully may be taken as proof of local cultivation. With a few exceptions, this would apply to all major finds dating after 1100 from southern Arizona and southwestern New Mexico to southern Utah and Colorado.

There were probably some villages, situated in areas especially favorable to cotton cultivation, which fur-

[15] Brand, 1935: 202.
[16] Kidder and Guernsey, 1919: 113.
[17] Haury, 1945*b*: 26.
[18] Pepper, 1920: 107.
[19] Nordenskiöld, 1893: 94–104.
[20] Hough, 1903: 341.

nished raw fiber and even woven cloth to towns where the plant was scarce or entirely lacking. It is felt, for example, that the people of the Estancia Basin could not have grown the cotton they used, but must have got it from the Rio Grande Valley.[21] Cotton in the Flagstaff area is thought to have been traded in from farther south, since growing the plant in that high, cool region might not be feasible.[22] In this connection the suggestion has been made that the presence of pottery from the Flagstaff area at Snaketown and the scarcity of Hohokam pottery in corresponding northern sites might be explained on the basis that the Sinagua were trading pottery to the Hohokam in return for cotton and other perishable goods.[23]

Haury, in his report on the Canyon Creek Ruin, where arable land is extremely limited, states:

> It is doubtful whether cotton was raised in the immediate vicinity of the site, the supply having come, no doubt, from the more low-lying basins and valleys to the west and south. The absence of cotton stalks, bolls, and seeds in the rubbish might indicate that only fiber was acquired.[24]

It is expressly stated that no seeds or plant parts were found at Tularosa Cave, although cotton "probably would grow if the right varieties were planted." [25] The Eastern Mogollon, even if they were the first Southwesterners to acquire cotton, may never have grown it locally to any great extent.

The people of Ventana Cave may well have received their cotton from the River Hohokam through some such trade relationship as that recorded in 1900 for the Pima and Papago.[26] At that time the Papago were trading cords of human hair, maguey fiber, carrying baskets, body paints, buff color for dyeing textiles, saguaro fruit, and even salt, which they obtained in annual pilgrimmages to the sacred salt lake in Sonora, to the Pima in exchange for corn, beans, cotton blankets, and cotton fiber, with the seed.

NATIVE CULTIVATION OF COTTON FROM 1540 TO THE PRESENT

At the time of Spanish entrance into the Southwest the people of the Rio Grande Valley were growing cotton probably as far north as the villages around the modern town of Española, at the confluence of the Chama and Rio Grande Rivers. Cotton was grown at Acoma, but little, if any, was raised at Zuni. Espejo reports seeing large fields of it in the Hopi country. From all accounts Hopiland was supplying Zuni and the Rio Grande towns with woven cloth and also some cotton fiber, a practice which has continued until the present time.[27] In southern Arizona the growing and weaving of cotton was important in the Gila Valley. In the early 1700's the Sobaipurai had large fields of it along the San Pedro and Santa Cruz Rivers. The Pima on the middle Gila were growing it extensively, and it is said that:

> So much cotton is raised and so wanting in covetousness is the husbandman, that after the crop is gathered in, more remains in the fields, than is to be had for a harvest here in Sonora—this upon the authority of a Missionary Father who saw it with his own eyes in the year 1757.[28]

Although early accounts do not specifically credit the Papago with raising cotton, living Papagos insist that within their memory it was grown in favorable places by flood-water farming, the fiber to be used in weaving, and the seed for food. They supplemented their supply by trade with the Pima.[29] The Maricopa are said to have grown cotton until about 1860.[30]

The cultivation and use of aboriginal cotton gradually declined after the introduction of sheep by the Spanish and with the increasing accessibility of commercial yarns and woven cloth. It practically ceased in southern Arizona after 1900. Since the turn of the century only small amounts have been grown at some of the Pueblo villages for ceremonial use. This practice may still be observed in the conservative towns, although there are no records of it since White's report of cotton at Santa Ana in 1934.[31] The Hopi were the last to relinquish large-scale cultivation of the plant. It was grown at Moenkopi (a name meaning "cotton fields") probably into the early '30's.

II. THE GROWING OF COTTON AND ITS PREPARATION FOR WEAVING

PROBABLE TECHNIQUES OF CULTIVATION AND HARVESTING

Prehistoric methods of growing and harvesting the cotton plant can be reconstructed on the basis of accounts of modern Hopi, Zuni, Maricopa, and Pima practices, plus data on prehistoric agricultural techniques in general. Flood-water farming in some form was practically universal. The principle of this is, in brief, to plant crops in fields that will be watered by the run-off of a large area during the seasonal rains and flash floods characteristic of the arid Southwest. Water must be directed onto the fields in sufficient quantity to soak the crops, but not to such an extent that it washes them out or covers them with silt. This type of farming, as practiced by the Hopi today, was probably widespread in northern Arizona and other parts of the Southwest prehistorically. The Hopi plant crops on the flood plains of large water courses or at arroyo mouths where flood waters will commence to spread out over the alluvial fan. These water courses, dry

[21] Brand, 1935: 202.
[22] Bartlett, 1934: 46–47.
[23] Gladwin *et al.*, 1937: 219.
[24] Haury, 1934: 87.
[25] Martin *et al.*, 1952: 463 and 475.
[26] Russell, 1908: 93–94.
[27] Jones, 1936: 51–53.
[28] Castetter and Bell, 1942: 103–104.
[29] Russell, 1908: 93–94.
[30] Hrdlička, 1905: 361.
[31] Jones, 1936: 53; White, 1941.

during most of the year, will run for several days after a rain, so that the fields near them receive great quantities of moisture over a long period of time, this moisture being stored in the soil until the next rain. Planting is done in late May, several seeds being placed together in a hole. Holes are made with a simple, pointed digging stick. Planting and cultivating is man's work. It is believed that the Hopi formerly grew cotton along with corn in fields of this nature.[1]

Cotton cultivation as practiced by the Maricopa in the 1800's illustrates a method of flood-water farming which may have been practiced prehistorically along the water courses of southern Arizona. These Indians grew the plant in the bottom lands of the Gila River, depending wholly on inundation at flood periods, and on sub-surface seepage, for water, until 1850 or so when they began to use true irrigation. They planted two crops a year, one early in March, a month after the winter floods, and one early in August, after the first heavy summer rains. Harvests occurred in July and September. Planting and cultivation were man's work.[2]

Canal irrigation from living streams was, of course, important among the inhabitants of the middle Gila and Salt valleys, where the practice dates back to at least 800. Methods used by the Pima for the cultivation of cotton in irrigated fields probably paralle1 those of the Hohokam. The seed was planted in late March or early April when the mesquite leaves put forth and danger of frost was over. The ground was first saturated with water and allowed to dry out for about a week. The seed was planted about three inches deep in hills six inches in diameter spaced about one to one and a half feet apart. Hills were arranged in rows two feet apart. Here, as elsewhere in the Southwest, holes were made with a simple digging stick. Three to five seeds were placed in each hole. As the crop grew it was irrigated three or more times if the condition of the river permitted this. Weeds were removed from around the plants. Cotton took about eleven weeks to mature, but need not be harvested until all the other crops were out of the way, in late October or early November. Historically only one crop of cotton per summer was raised, although a second crop of most other plants was put in in mid-August. Planting was more or less of a family affair, the man being assisted by the older children and his wife, if she were free. Subsequent cultivation and irrigation were the man's responsibility.[3]

In recent years the small amount of native cotton required for ceremonial purposes among the Pueblos has been planted in garden plots close to the village and watered by hand. Since this practice may have been followed to some extent prehistorically, we quote Spier's description of it at Zuni. His informant was referring to the period around 1860 or 1870.

> The cotton seed was planted (in July) in holes about one and a half inches deep and covered with white sand. The garden patches are divided into sections about a foot square by little dirt borders to make watering by hand easier. The seed was watered for three days following planting, but during the next three days received no water. This alternation continued until the cotton was ripe. The plant received no other attention. . . .[4]

The hand-irrigation of small garden plots is today considered woman's work among the Puebloans, as opposed to field farming.

Our method of harvesting cotton is to allow the bolls to ripen and burst open on the plant, after which the lint is removed, and the pod fragments left attached to the stalk. The custom in the aboriginal Southwest varied from this in that bolls were plucked from the plants and ripened by drying in the sun on the roof tops. If danger of frost threatened, whole plants might be cut down and carried home to dry, after which bolls would be removed from the stems. When the cotton had dried, the fiber and seed were separated from the pod and stored in the houses until needed. Castetter and Bell do not mention storage of the fiber, but remark that the Pima placed the seed in sealed ollas and kept it for food.[5]

Harvesting among the Pueblos is today, and probably was prehistorically, a communal affair. Men and women repair to the fields designated by the official in charge when crops are ripe in September or early October, bringing back produce in pouches, blankets, and baskets, and spreading it on the roofs to dry. Among the Pima and Papago the harvest is traditionally woman's work.

GINNING AND CARDING

After its separation from the boll, the cotton must be cleaned by removing seeds and dirt particles, and the matted mass of fibers pulled apart and arranged loosely in pads or laps from which they can be drawn out in spinning. The first of these processes is termed "ginning" and the second "carding."

Two methods of ginning and carding have been recorded for the Hopi, and probably represent prehistoric Pueblo techniques. In the first, the seeds were picked out by hand and the cotton fibers thrown in a pile on a heap of clean sand. A number of men sat around the pile and beat the cotton lightly, each with three slender rods held in his right hand, radiating from fingers and thumb. The cotton became a fluffy mass, the sand cleaning and whitening it. This was all the "carding" that was done up until the time that the Indian weavers began to use commercial cards, around 1852.[6] A second way of preparing cotton for

[1] Hack, 1942: 19.
[2] Spier, 1933: 58–61.
[3] Castetter and Bell, 1942: 102–107.
[4] Spier, 1924: 64.
[5] Castetter and Bell, 1942: 198.
[6] Stephens, 1936: 1181–1182. A commercial card is an oblong board with wire teeth set on one surface, and with a handle on one long edge. A bunch of fiber is placed on the teeth of one card and combed with those of a second card. This is essentially

spinning was to place the mass of unginned raw cotton between the folds of a blanket and to beat upon the blanket with a three-pronged switch. The beating served to loosen seed from fiber and caused the latter to adhere to the surface of the blanket, from which it was scraped and arranged with the fingers into loose laps for spinning.[7]

A Hopi cotton beater in the Museum of Northern Arizona collections is made of five slender sticks about two feet long bound together at their bases and radiating from this point. Kidder and Guernsey found similar tools cached behind the rear wall of a small granary in a Pueblo III site near Kayenta. These they describe as follows:

> . . . They were made by lashing together at the butts five or six slim willow twigs 24 inches long in such a way that they all lie in the same plane, spreading apart from each other a little toward the tips. The twigs are peeled, except at their butts, where they are fastened together with sinew bindings and overwrappings of yucca string. The workmanship is extraordinarily neat.[8]

The authors believed these fan-like objects were used in knocking seeds from grass plants into carrying baskets. However, they are very like modern cotton beaters (fig. 2, A).

Among the Hopi the ginning, carding, and spinning of cotton were carried out by groups of men in the kivas, often as part of the preparations for a ceremony. These processes were sometimes accompanied by elaborate religious ritual. Such an occasion was recorded in detail by Matilda Coxe Stevenson. Her account may refer to preparation of cotton for use in a bride's outfit. The manuscript is not clear on this point. The description reads, in part:

> The writer observed the preparing of cotton for the loom at the Hopi village of Shimopavi in 1882. This ceremony, which is strictly religious, must be performed with many prayers. A piece of white commercial cotton cloth was spread upon the floor in the chamber of the high priest (head rain priest) and a disk-shaped bed of sand was laid upon the cotton cloth. Several men headed by the high priest took seats around the sand bed and immediately began to pray. In a short time two men appeared bringing a dressed deerskin with a painting of the sun in the center. . . . The painting was gently deposited upon the sand bed, where it remained while a long prayer was offered by the high priest and was responded to by others in tones too low to be heard by the writer. After the prayer each one seated around the painting sprinkled it with sacred meal and drawing his hand to his mouth inhaled the sacred breath from the living god, as it were, for the sun father was supposed to be present in spirit in the shield. The painting was again sprinkled with sacred meal when it was gently lifted and returned to its resting place by the men who brought it. The process of manipulating the cotton then began. A white cloth containing cotton pods was deposited by the sand bed and each man of the circle began picking the cotton and placing it on the bed. The picked cotton was patted with a willowy rod, some two and a half feet in length with five fingers or prongs wrapped securely to it. Great care has to be observed in the patting of the cotton for the slightest carelessness will cause it to fly. The process is most fatiguing, owing to the peculiar motion of the arm. The better part of a day was required to prepare but a small quantity of cotton for the spindle. . . . The Zuni practice the same process as the Hopi in preparing cotton for spinning, except that they do not observe any ceremony further than to pray much of the time that they are separating the cotton.[9]

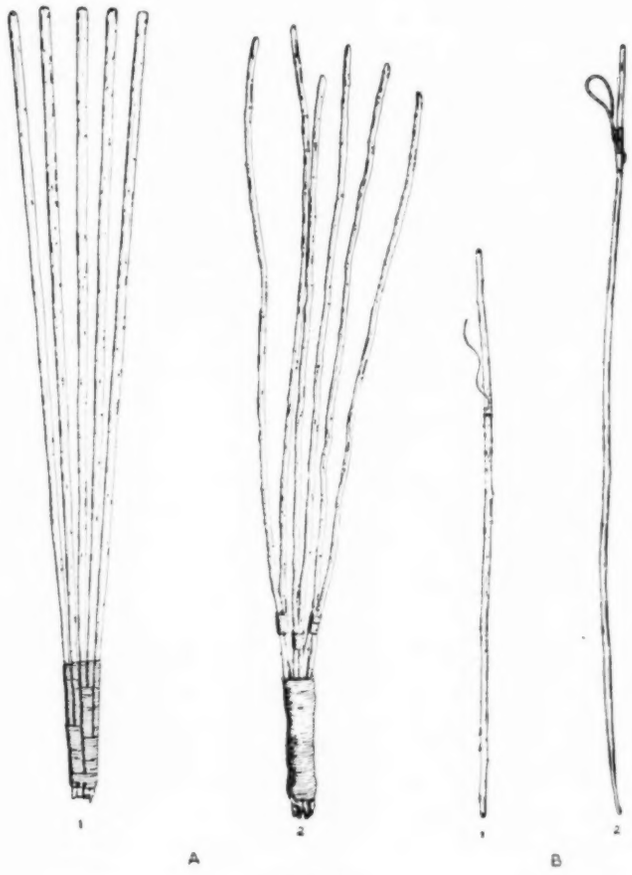

FIG. 2.

A. Ginning tools: (1) Modern Hopi. (Museum of Northern Arizona.) (2) Prehistoric, northern Arizona. (Kidder and Guernsey, 1919, pl. 48, b.)
B. Finishing needles: (1) Prehistoric, northern Arizona. (2) Modern Hopi. (Both examples are in the Museum of Northern Arizona collections.)

Accounts of Pima and Maricopa ginning and carding show how these steps were accomplished in southern Arizona historically, and perhaps in pre-Spanish times. The work was done by the women as one of their household tasks, and there was no religious ritual associated with the process. The Pima, says Russell: ". . . removed the seeds by first spreading out the cotton

a process used for cleaning and straightening *wool* fibers, but it has been adopted for cotton by Pueblo weavers.

[7] Conversations with Jimmy Kewanwytewa of Shungopovi, Museum of Northern Arizona, 1940.

[8] Kidder and Guernsey, 1919: 120.

[9] Stevenson, n.d.

and beating it with a switch."[10] The beating process, then, served to gin, as well as to card, the cotton. Ginning was accomplished by these Indians in yet another fashion, described by Castetter and Bell. This was:

> . . . To turn upside down a thick pottery vessel about fifteen inches in diameter made specifically for the purpose. A mat of cotton bolls was stretched over the bottom of the vessel and a smooth arroweed stick (about eighteen inches long and three-fourths of an inch wide), from which the bark had been peeled, was rolled over the cotton, working the seeds out of the lint and toward the edge of the mat, where they dropped over the side of the bowl. This was continued until all seeds were removed.[11]

Spier's description of Maricopa ginning, quoted below, closely parallels that for the Pima, from whom they acquired their cotton:

> They ginned the cotton by first beating it with a little stick. Then, spreading it on a flat stone, they rolled a smooth arrowweed across it to remove the seeds. This lap was laid aside; then others were similarly prepared and laid on the first. This was women's work alone. Day after day was spent in preparation until the necessary amount was accumulated.[12]

Historically, both Pima and Maricopa further prepared the fibers into loose rolls for spinning with the aid of the plucking bow, an instrument of European introduction which need not concern us in the reconstruction of pre-Spanish methods. Ginning by "pressing" out the seeds with a stick is not mentioned by Russell, Bartlett, or Emory in their accounts of the Pima, and I have not read of its use by native weavers of Mexico, Guatemala, or Peru. I have no explanation of its history within the Southwest. A rolling-pin-like object was found in the Canyon Creek ruin along with refuse containing spindle whorls and loom parts.[13] The suggestion was made to Dr. Haury by a Pima workman that it looked like the ginning tool his people once used. Note that it would not resemble the simple stick roller described in the quotation above by Castetter and Bell.

So far as we know, then, ginning and carding in the pre-Spanish Southwest were simple hand operations. Ginning was usually a matter of picking out seeds and dirt by hand, and carding was ordinarily done by beating the cotton lightly with long, thin sticks. Sometimes the two steps might be accomplished together through the beating process. The Indians of southern Arizona may also have ginned cotton by pressing out the seeds with a roller. If *Gossypium hopi* was the species used, these tasks were relatively easy, since the fibers of this cotton do not adhere closely to the seed.

Primitive "finger-ginning" and "switch-carding" techniques, almost identical to those described above for the Hopi, were observed by Dr. O'Neale in Highland Guatemala, and are recorded for isolated cotton weavers in Mexico.[14]

SPINNING

BASIC STEPS IN SPINNING

Spinning is the process of twisting fibers together into thread. This is done with the aid of a spindle, which, in the Southwest, consists of two parts—a smooth, slender stick varying in length from 10 to 30 inches, and slightly pointed at one or both ends; and a whorl, or weight, affixed to the shaft nearer one end than the other (fig. 3, A). The spindle tip is fastened to one end of the lap of fibers. The base of the spindle rests on the ground or in a "cup," or the shaft may be held against the upper leg. The shaft is turned and kept in motion with the right hand, the whorl helping to supply momentum. The unspun lap is held in the left hand, and as the spindle turns loose fibers are twisted together into a thread, which forms between the spindle tip and fingers of the left hand. Spun thread is wrapped around the shaft above the whorl.[15]

Shaft-and-whorl spinning was associated with *cotton* fiber in the pre-Spanish Southwest. Therefore, the finding of spindle shafts or whorls in a site indicates that cotton was used there, even though fiber, thread and cloth may not have survived. Several varieties of whorls have been employed by native weavers.

TYPES OF SPINDLE WHORLS

Whorls Molded from Pottery Clay (Fig. 3, C)

Whorls of various shapes, molded of pottery clay and fired, are found in southern Arizona, the Verde Valley, the Prescott and Flagstaff areas—that is, within the range of Hohokam occupation and influence—in sites dating after 1100. These are around an inch in diameter, with central holes averaging $\frac{5}{32}$ inch across. They resemble, somewhat, pottery bead whorls from Mexico, especially those found along the Pacific Coast of Nayarit and Sinaloa, and are thought to have been inspired by late southern influences. A fragmentary pottery whorl from Pecos is explained as an import from northwest central Mexico. Clay whorls are not made in the Southwest today.[16]

The recent discovery of what are thought to be five molded pottery whorls in Tularosa Cave does not seem to fit the above picture. Roughly disk-shaped in form, they range between one and two inches in diameter, and a quarter to a half inch in thickness. Fragments of spindle shafts (?) remain in the center holes of two. Three of these are assigned to the Georgetown, and two to the San Francisco Phase, which places them all be-

[10] Russell, 1908: 148.

[11] Castetter and Bell, 1942: 199. "Bolls" in this quotation must mean bunches of cotton as removed from the pods.

[12] Spier, 1933: 113.

[13] Haury, 1934: 114.

[14] O'Neale, 1945: 7–8; Osborne, 1935: 37.

[15] Detailed descriptions of spinning may be found in the following references: Jones, 1946: 43–51; O'Neale, 1945: 8–9; Osborne, 1935: 37–38; Reichard, 1936: 17–23; Spier, 1933: 114.

[16] *Cf.* Haury, 1945*a*: 115–120.

tween 500 and 900, or considerably earlier than the Hohokam clay whorls. None are found in later horizons in southwestern New Mexico.[17]

Disk-shaped Whorls of Wood and Other Materials (fig. 3, B)

Among the Pueblo people after 1100 spindle whorls generally take the form of flat wooden disks. These are quite common in San Juan sites, and have been found at Pueblo IV Canyon Creek.[18] They are identical in form to spindle whorls of contemporary Hopi and Navaho. Typical specimens range in diameter from 2 to 4 inches, and are from $\frac{1}{8}$ to $\frac{1}{4}$ inch thick at their centers. Central perforations are $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter. Some of the circular wooden whorls from Kiet Siel and Gourd Cave are very thick—in a few cases actually tubular in shape (fig. 3, B, 2). These forms are not recorded from other northern sites. Besides wood, gourd rind, slate, and mountain sheep horn were used. Whorls made from the latter two materials are exceptionally flat and carefully worked.

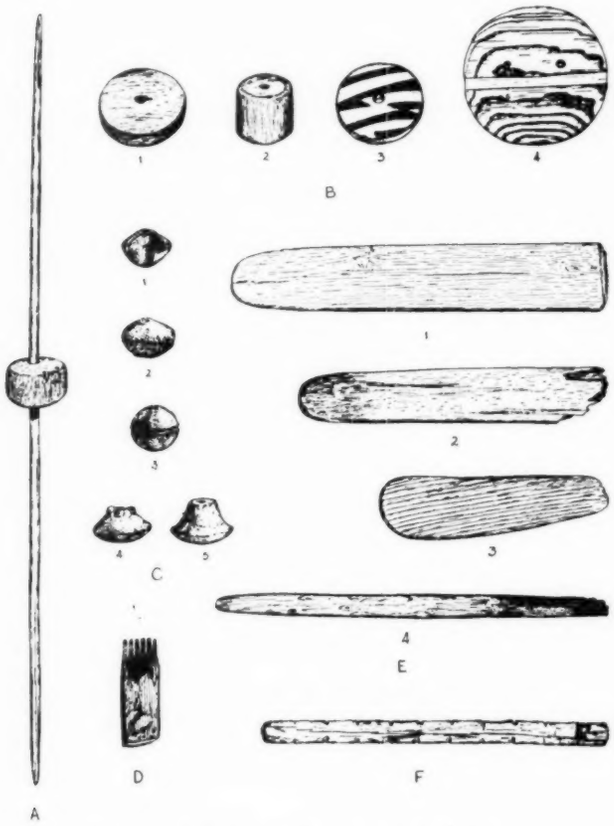

FIG. 3. Spindle whorls and weaving tools.

A. Whorl and shaft from Kiet Siel. (These pieces were found separately and fitted together. The position of whorl on shaft may not be exact. MNA 695/NA2519.4E6.)
B. Spindle whorls: (1) Disk whorl of wood, Kiet Siel. Diameter, 2". (MNA 695/NA2519.79.) (2) Tubular whorl of wood, Kiet Siel. (MNA 695/NA2519.M35.) (3) Whorl fashioned from a pot sherd, Wupatki. (MNA 621/NA405.R46.B.4.) (4) Wooden disk whorl from Wupatki. The center band of wood has been recently set in to hold the two parts together. The broken whorl had been repaired prehistorically by drilling holes in each half and binding them together. Diameter, about $3\frac{1}{4}$". (MNA 621/NA405.M42.)
C. Pottery whorls from Los Muertos. Diameter of number 4, $1\frac{3}{16}$". (Haury, 1945*a*, figs. 71, *k*, *l* and 72, *a*, *d*, *h*.)
D. Weaving comb, Kiet Siel. (MNA 695/NA2519.128.)
E. Batten fragments: (1) Length, incomplete, $8\frac{1}{2}$", Kiet Siel. (MNA 695/NA2519.122.) (2) Wupatki. (MNA 693/NA405.M161.) (3) Site unknown. (MNA.) (4) Kiet Siel. (MNA 695/NA2519.117.)
F. A stick marked into segments. Probably a temple, or tenter. Wupatki. (MNA 693/NA405. R1.1.)

[17] Martin, *et al.*, 1952: 196 and fig. 66, *f–j*.

Perforated Sherds (fig. 3, B, 3)

Circular objects, similar in size to disk whorls, were fashioned from broken pottery. Some of these are crudely shaped, others have neatly ground edges and are true disks in form. Holes have been bored through the centers of some, giving them the appearance of spindle whorls. Perforated disks were found at the Bluff Site (Hilltop Phase, *ca.* 400) and at Snaketown (Sweetwater Phase, 500–700). They are well represented in Hohokam sites from 700 on, but are rare in the San Juan area until after 1100. They are found in nearly all Pueblo III and IV sites, and, according to Haury, occur also in Mexican ruins and in pottery-bearing sites the world over.[19]

At the present time there is so much doubt about the distribution and use of these disks that their appearance in a site should not, in my opinion, be taken as evidence of spindle-spinning. The more carefully fashioned perforated sherds do function satisfactorily as whorls, but experiments with a spindle weighted by an asymmetrical sherd prove it to be a very poor tool. It seems likely that the latter were never intended to be whorls, but served the same purpose as the non-perforated sherd disks often found in association with them. These are generally called gaming pieces or counters. At Winchester Cave pairs of disks were bound together with cotton string, suggesting some sort of ritual use (fig. 124, C). We are left with the question of when, if ever, should a perforated sherd be called a whorl? [20]

Crossbar, or Stick Whorls

Pima and Maricopa spindles are made by binding a short stick at right angles to the spindle shaft, several inches above its lower end; or by running the shaft through a hole in the crossbar. Spier describes one as an arroweed shaft 2 feet long and $\frac{3}{8}$ inch thick, with a

[18] Haury, 1934: 110 and pl. LXVI. Fewkes, 1909: 43 (the spindle shaft illustrated by Fewkes has a notched tip, a feature not noted elsewhere); Kidder and Guernsey, 1919: 121 and pl. 51. Wooden whorls are present in collections from Gourd Cave (ASM) and Kiet Siel (MNA).

[19] Haury, 1945*a*: 119.

[20] For information on the distribution of sherd disks see: Smith, 1952*a*: 149–153.

crossbar fashioned from the inner part of the giant cactus—a straight stick about 5 inches long and an inch wide and bored in the middle to slip on the shaft about 6 inches from its lower end. The lower end of the shaft was rounded, the upper end somewhat more pointed.[21]

This type has not been reported from prehistoric Pueblo or Hohokam sites. Its possible analogy to the BM III Anasazi crossbar spindle, used for making hair cord, is discussed below (pp. 475–476).

The archaeological record, as we know it, then, shows that prior to 1100 specialized whorls were lacking in most parts of the Southwest. Tularosa Cave is the great exception. Perforated sherd disks are present in southern sites from 500 on, but not found in quantity in the San Juan before 1100. They are ubiquitous in the Southwest after that date. They are not, however, to be considered reliable evidence of spindle-spinning. The lack of specialized whorls in P I and II sites may be accounted for in several ways:

(*a*) The use of cotton may have been much less widespread prior to 1100 than I have indicated in the previous pages.

(*b*) Perforated sherd disks may actually have been whorls.

(*c*) Cotton fiber may at first have been spun by rolling it between the palm of the hand and the thigh—a method already in use for bast fibers. This transfer of techniques has been observed historically among the Yuma, who obtained cotton from the Pima, but did not adopt the spindle with it.[22] This is not a very satisfactory method for spinning short, fine fibers like cotton.

(*d*) Weightless shafts may have been used. This is a slight aid to spinning cotton and has been observed recently by Junius Bird in northern Peru.[23] Stevenson makes the statement that ancient Zuni spindles had no whorls, which is at odds with an earlier remark of hers to the effect that the spindles were equipped with stone or wood disk whorls.[24]

(*e*) Early whorls may have been made of a perishable material like wood or squash rind, so that they have not survived in open sites; *or,* they may have been so unspecialized in form that they are not recognized as whorls. In this connection I have in mind the crossbar spindle, which as we have seen was sometimes made of two simple sticks.

A RECONSTRUCTION OF PREHISTORIC SPINNING TECHNIQUES

The basic steps in spindle-spinning have already been outlined (p. 472). A study of the process in the Southwest today shows some interesting variations in technique which may have been present prehistorically (fig. 4).

Spinning with a Disk Whorl Spindle

One contemporary method of cotton spinning has been well described by Spier for the Zuni,[25] and was demonstrated for me by the Hopi weaver, Jimmy Kewanwytewa, in 1944. The spindle whorl is very near the center of the shaft. In spinning the longer length of the

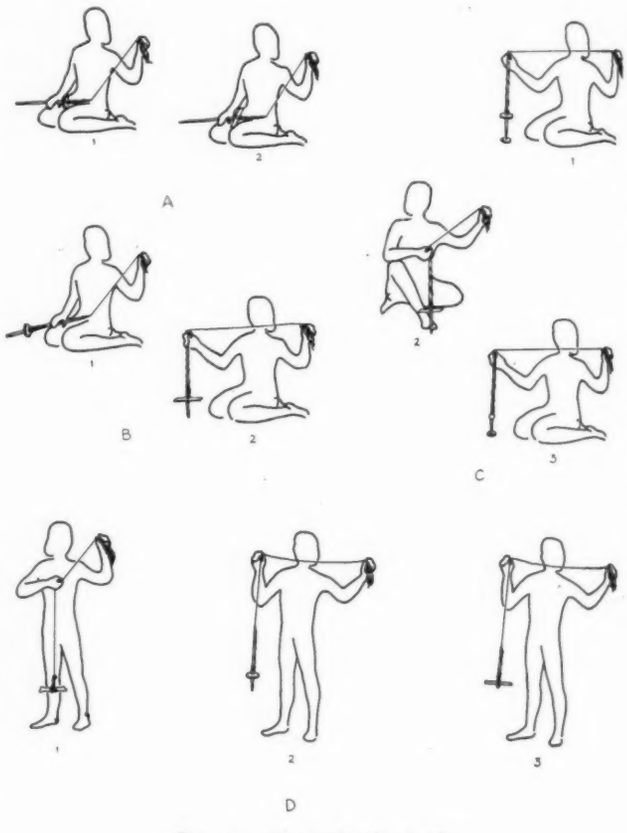

FIG. 4. Methods of spinning.

A. Spinning with the shaft supported on the thigh and thread spun off the short end of the spindle. (1) Disk whorl spindle as used by Hopi, Zuni and at Canyon Creek. (2) Cross bar spindle, as sometimes handled by the Maricopa.

B. Two other ways of handling disk whorl and cross bar spindles. (1) Disk whorl spindle with tip of short section rested on the ground and longer part rolled on thigh. Pueblo and Navaho. (2) A second Maricopa technique of spinning with the cross bar spindle.

C. (1) The disk whorl spindle with tip rested in a small bowl. Eastern Pueblos. (2) Spinning with the cross bar spindle, as practiced by the Pima. (3) Spinning with a bead whorl spindle. Mexico, Guatemala and possibly Hohokam.

D. Spinning with drop spindles. (1) The twisting of camel's hair cord with a drop spindle made of an iron rod with a hook at the upper end, and a cross bar of bone. Inner Mongolia. (2) The disk whorl spindle, as used for spinning wool thread by Guatemalan men. (3) Spinning human hair cord with a cross bar drop spindle as probably done by the San Juan Basketmaker.

[21] Spier, 1933: 114. See also: Bartlett, 1854: 225; Russell, 1908: 149.

[22] Forde, 1931: 126.

[23] Bird, conversation, 1946.

[24] Stevenson, 1915: 77 and 1904: 372.

[25] Spier, 1924: 66.

shaft rests against the right thigh, the whorl being above or to the left of the thigh. The spindle lies almost horizontal and is supported by the roving of cotton fibers fastened to the tip of the shorter length, and running in turn to the left hand. The shaft is rolled up along the right thigh (from knee towards body) and kept turning by the right hand, while thread forms between its upper tip and the left hand. Finished lengths of thread are wound about the shaft above the whorl—that is, on the shorter length of the shaft (fig. 4, A, 1).

The position of the yarn and that of the whorl on the shaft of a spindle from Canyon Creek (fig. 5) indicate that the technique of spinning was the same as that described for the Hopi and Zuni. A length of spun yarn—the first spinning, judging from its loose twist—is wound on the shorter section of the shaft above the whorl. The whorl is near the center of the shaft.

Other ways of handling the disk whorl spindle have been observed among the Hopi, Zuni, Navaho, and eastern Pueblo peoples. For these the whorl is generally placed well toward one end of the shaft. The shorter length of shaft functions as the *lower* part of the spindle. The lower tip may be placed on the ground to the right of the worker, with the shaft above the whorl resting against the right thigh. In spinning the right hand rolls the spindle up the thigh [26] (fig. 4, B, 1). A somewhat different method is to rest the lower tip on the ground or in a shallow bowl, with the shaft held upright and turned by the fingers of the right hand at its upper tip. The practice of resting the spindle tip in a small bowl, gourd, or pottery fragment is associated in Mexico and Guatemala with bead whorl spinning of cotton. In the Pueblo area it appears to be confined to the eastern Pueblos (fig. 4, C, 1). Its occurrence there with disk whorl spinning may indicate influence on technique from a bead whorl area—perhaps pre-Spanish southern Arizona. The position of the thread on a spindle shaft from Te' ewi indicates one of the latter methods was used there.[27]

Spinning with a Bead Whorl Spindle

The technique is the same as that just described, that is, the lower tip rests in a sherd or bowl, and the shaft is twirled by the fingers of the right hand (fig. 4, C, 3). Bead whorls are not recorded historically in the Southwest. The prehistoric clay whorls of southern Arizona are, for the most part, bead rather than disk-shaped, and spinning techniques among the Hohokam may, therefore, have resembled the bead whorl spinning of their neighbors to the south.[28]

Spinning with a Crossbar Spindle

Among the Pima the crossbar spindle was handled in the same manner as a bead whorl spindle, the shaft being held upright. The spindle tip was placed between the toes, or in a wooden cup inserted between the toes. It may be that the method of spinning carried over from the Hohokam, even though the shape of the whorl changed from bead to stick or bar [29] (fig. 4, C, 2).

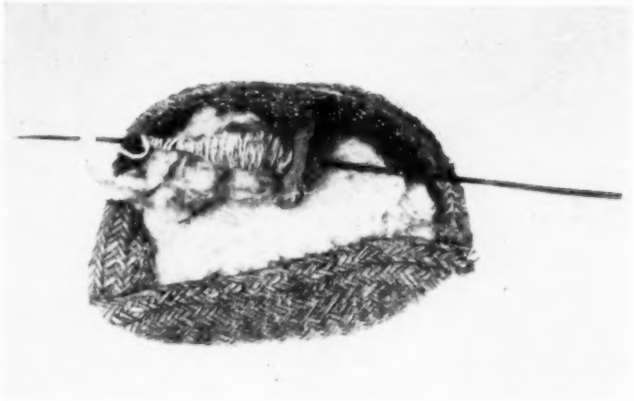

FIG. 5. Basket containing raw cotton and spindle partially filled with spun yarn. Canyon Creek Ruin. (Photo by Gila Pueblo.)

Maricopa spinning represents an interesting Pima-Pueblo blend.[30] The spindle resembles that of the Pima, but it was never supported between the toes or in a cup between the toes. The lower tip was rested on the ground while the shaft was held and twisted by the fingers of the right hand (fig. 4, B, 2). An alternative method was to rest the spindle, lower tip uppermost, against the right thigh, and to roll it between the right palm and thigh. This is like the first disk-whorl technique described above for Hopi and Zuni, except that the Maricopa are said to support the spindle tip in the cupped left hand while spinning (fig. 4, A, 2).

Spinning with the San Juan Basketmaker Crossbar Spindle

A number of spindles for making human hair cordage, found in the Tsegi, are assigned to the Basketmaker III period. These may also have been used in spinning other animal wools, such as dog, mountain sheep, and bear. Guernsey's description of them and his theories on how they might have been manipulated, follow:

> In a number of caves we have found sticks bound together in the form of a cross. None of these was complete, but the care with which they were made and the appearance of long handling indicated that they were for some practical purpose. We had no idea what this could be until we recovered from Room n, Cave 1, one of these bundled up with a hank of human hair and a small amount of hair-cord in the process of making (Plate 31, f). From this it seems safe to assume that this is a form of spindle used in the manufacture of hair-string and possibly other kinds of string. Just how they were used we do not know. Aborigines of North Queensland (f.n.—Roth, 1901) use a

[26] Amsden, 1949: pl. 13.
[27] Wendorf, 1953*b*: 101–102.
[28] O'Neale, 1945: 8–10.
[29] Russell, 1908: 148–149, gives good descriptions of Pima spinning.
[30] Spier, 1933: 114.

spindle consisting of a shaft with a short piece of stick bound to one end at an angle to the shaft forming a sort of hook. These are used in twisting human hair-string, by rolling on the thigh or twirling between the fingers. Mr. Willoughby suggests that they may have been used for twisting two-strand, a strand being fastened to each end of the crosspiece. Experiment showed that a close, even twist could be produced in this way. The spindle in the figure has 5 inches remaining of the shaft; the unbroken crosspiece is 7½ inches in length. Another specimen has 7½ inches of the shaft remaining, and a complete crosspiece 9 inches in length.[31]

Montell, in his excellent account of spinning methods in Asia,[32] describes and illustrates a crossbar spindle used by the Chinese caravaneers of Inner Mongolia for making camel's hair cord. The spindle consists of a short wooden bar or bone fastened at right angles to a slender rod of wood or iron. The crossbar is thicker than that in the Basketmaker examples but, as in them, is fastened almost at the lower end of the rod. A short length of hair cord is first twisted by hand, and then attached to the rod. The spinner starts the crossbar rotating in mid-air and allows it to drop downward at the same time. The hair is held in his left hand, and is gradually drawn out and twisted into thread by the downward pull and turn of the weighted rod. After a length of thread has formed between the tip of the spindle rod and the fingers of the left hand, it is wound on the crossbar and fastened at the spindle tip by a half hitch. A second length is then spun and wound in the same manner (fig. 4, D, 1). It seems probable this is the manner in which the Basketmaker spindles were operated. The presence of these tools in Basketmaker sites indicates that the people were familiar with the principle of spinning with a weighted shaft before they received cotton.

Superficially the Basketmaker crossbar spindle resembles that of the modern Pima, but the bar of the former is fastened at the lower tip of the shaft, while that in the latter takes the position of a disk or bead whorl some inches above the lower tip. The Basketmaker spindle probably functioned simply as a rotating weight, hanging in mid-air from the end of the twisting thread (fig. 4, D, 3). The Pima spindle was designed to be used with its lower tip resting on the ground. It may represent a modification of the crossbar drop spindle made when cotton was introduced into the Southwest, and surviving to the present day in spite of the bead and disk whorl spindles so widely used after 1100.

In Peru the drop-spindle technique is today—and apparently was prehistorically—used in spinning wool. This is true also in Guatemala, where wool yarn is produced by the men with a disk whorl drop spindle, as opposed to cotton yarn spun by the women with the bead whorl spindle (fig. 4, D, 2).[33] No drop spindle spinning has been recorded historically in the Southwest. Wools—or animal and human hair—were an important source of textile fiber among the Basketmaker. By Pueblo III and perhaps earlier, cotton had become the major raw material. Some human hair cord was still made, and animal hair was twisted between the plies of cotton string to make a warm yarn (p. 478) but, so far as I know at present, regular wool thread was not being spun. Drop-spindle spinning may have been discarded along with the spinning of animal hair, to be replaced by techniques better suited to cotton. The older method did not return after the introduction of sheep by the Spanish and the subsequent widespread usage of wool. Wool in the historic Southwest is simply spun in the same manner as cotton.

As to the division of labor in spinning, among the Pima and Maricopa it is women's work. The spinner's kit at Canyon Creek was found with the mummy of a woman. In the Pueblo area today spinning is definitely associated with the men, except at Zuni, and even there the men are thoroughly familiar with the process. Stephens, in discussing Hopi kiva activities at the time of an approaching ceremony, repeatedly speaks of men spinning and twining cotton string to be used in tying feathers on prayer sticks and for other ceremonial paraphernalia. He describes the spinning of cotton for the bride's outfit by male members of the groom's clan in the kiva. His excellent picture of a wool-spinning "bee" in a First Mesa kiva may represent the survival of a prehistoric custom associated with cotton spinning. In this instance a certain man had a quantity of wool he wanted spun. He arranged with the elders of a kiva to hold a gathering, and the kiva chief announced it. This was a social affair, with forty to fifty men participating. The men spun all day, being fortified for their tasks by a noonday feast brought to them by the women. As they worked they sang and discussed kachina songs. By evening the wool was spun and wound into balls.[34]

TYPES OF THREAD

COTTON

Nearly all of the cotton thread used in loom weaving is one-ply, Z-spun (fig. 6, A, 2). This means that it is a single strand in which the individual fibers are twisted together so as to trend in the same direction as the diagonal center line of the letter *Z*, if the thread is held in vertical position. The constancy of this feature is well illustrated by the fact that of the 288 cloth fragments at Tonto only 4 contained atypical S-spun thread. The individual fibers of an S-spun thread trend in the same direction as the center line of the letter *S*, the thread being held vertically [35] (fig. 6, A, 1).

[31] Guernsey, 1931: 82–83.

[32] Montell, in Sylwan, 1941: 109–125.

[33] O'Neale, 1945: 8, 15.

[34] Stephens, 1936: 372.

[35] The terms *Z-spun* and *S-spun* were adopted as standard usage for industrial literature by the International Cotton Committee at Paris in 1937. It is hoped that they will be used in all anthropological writings on textiles in the future, to avoid confusion. See: Sylwan, 1941: 23 and 111–112; and Emery, 1952: 251–262.

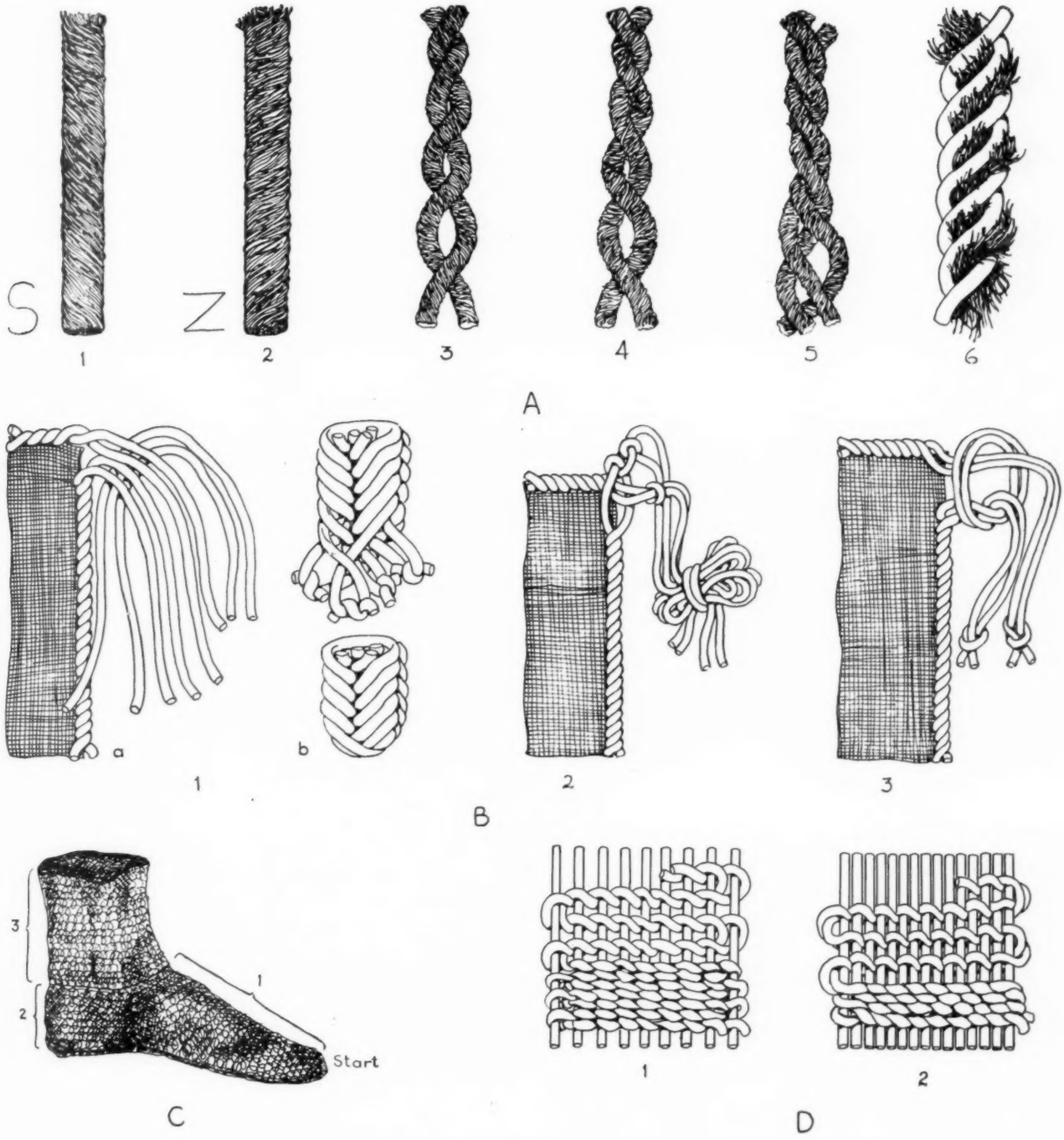

FIG. 6.

A. Types of thread. (1) S-spun, single-ply. (2) Z-spun, single-ply. (3) S-spun, Z-twisted, two-ply. (4) Z-spun, S-twisted, two-ply. (5) Z-spun, S-twisted, three-ply. (6) Three-ply, Z-twisted cotton string with animal hairs caught between the plies to make a coarse, warm yarn for closed loop shoe-sock uppers.

B. Corner tassels and braids on woven blankets. (1) An eight-strand corner braid fashioned from the warp and weft selvage strings with additional strings worked in with them. (2) The crude corner tassel, made from warp and weft selvage threads, on a blanket from Vandal Cave. (ASM 18543.) (3) A common method of knotting and tying off the selvage threads at blanket corners.

C. The way in which a closed loop shoe-sock upper was constructed. The toe and instep section were looped first (1), then the heel up to the ankle (2), and finally the ankle and leg portions (3).

D. Details of weft-twine techniques. (1) Weft pairs enclosing a single warp and then twisting about each other. (2) Weft pairs enclosing two warps at a time. Waterfall Ruin. (PM A–1655.)

Ordinarily thread used for warps is tightly-spun and ranges in diameter from 1/50 to 1/32 inch. Weft threads are usually somewhat thicker and more loosely-spun. They may be as wide as 1/16 inch.

Heavier thread was made by twisting together two or more single plies. This twisting, as a rule, takes the opposite direction from the original spinning. In other words, nearly all multiple-ply string is S-twisted (fig. 6, A, 4, 5). Two-ply thread was usually used for selvages, braids, embroidery, and sewing thread. It is only occasionally found in loom-woven fabrics. Three-ply string is nearly as common a selvage material as two-ply, and four-ply appears sometimes in this capacity. Five- and six-ply cords are rarely found. They have been recorded chiefly in coarse closed-loop fabrics.

Prehistoric weaving (single-ply) thread is like that found in modern Pueblo hand-spun cotton cloths except that it is noticeably finer. The coarseness of the newer material probably correlates with the current use of a large spindle with a thick shaft—an adjustment originally made for spinning wool fiber in post-Spanish times.[36] Single-ply Z-spun thread is produced among the Hopi today by rolling the spindle up the right thigh with the right hand. Two-ply S-twist thread is made by fastening the ends of two single strands to a spindle and rolling it *down* the thigh, or in the opposite direction.

BAST, OR VEGETABLE FIBERS

We are not going to undertake the description of bast fiber cloth and cordage, but articles in which cotton and bast are combined must be included in the discussions. A brief statement on vegetable fiber thread is therefore given.

Yucca and apocynum were the major sources of plant fiber in the aboriginal Southwest. Yucca fibers come from the leaves of the plants. To separate fiber from flesh, leaves were probably soaked for a time and then pounded. After this the flesh could be stripped from the fibers by drawing them between the teeth.[37] Yucca thread, according to my observations, is nearly always two-ply, S-spun, Z-twisted (fig. 6, A, 3), and has an average diameter of just under 1/8 inch. This checks with descriptions by Kidder and Guernsey of Pueblo III yucca twine from sites in the Marsh Pass area and with several other published accounts.[38] Yucca thread was probably spun on the thigh, without the aid of a spindle, after the fashion almost universally used by native peoples for spinning basts. The mass of unspun fibers is held in the left hand. Two lengths of fiber are drawn from the mass by the right hand and spun into two parallel threads by being rolled between the right hand and right thigh, with a downward or upward movement. The motion of the hand is then reversed, and the two spun threads are twined together. The process automatically produces, in one operation, a two-ply string, in contrast to spindle-spinning, whereby loose fibers are twisted into single-ply thread. Judging from the direction of twists in prehistoric Pueblo yucca thread, the spinning of the two separate threads was accomplished with a downward or thigh-to-knee motion, and the subsequent twisting of the two with an upward, or knee-to-thigh, motion.

I can give little information concerning apocynum fiber thread except to say that it was probably spun in the same manner as yucca, and that the fibers come from the stalk of the plant. It is sometimes so fine and soft that it is mistaken for cotton at first glance.

HUMAN AND ANIMAL HAIR USED WITH COTTON

Human hair string, so abundant in Basketmaker sites, was apparently still used to some extent for durable cordage and looped fabrics in Pueblo III. It is mentioned because looped bags from McEuen Cave are said to have been made by combining cotton cloth strips with human hair strings.[39]

The hair, or wool, of animals was sometimes spun into thread by the Basketmakers. The most famous examples of their woolen textiles are the dog hair sashes from northeastern Arizona.[40] They probably also used the hair of bear, buffalo, and mountain goats. Wool may have been used to some extent by post-Basketmaker peoples. A narrow slit tapestry band from the Tsegi, Pueblo I in date, contains some warps of this character (pp. 525–526). A sort of imitation "wool" yarn was manufactured by the Pueblo III Anasazi for use in closed loop shoe-socks (p. 589). This was done by incorporating animal hairs between the strands of multiple-ply cotton string as those strands were being twisted together (fig. 6, A, 6). The hairs fluffed out so as to cover completely the foundation cord. No identification of types of hair used has been made. After the introduction of sheep by the Spanish, true wool yarn replaced cotton-and-hair cordage.

The spinning of cotton and bast or wool fibers together into a single length of thread has not been remarked by me, although this may have been done. I have not put every fragment under the microscope, but those tested in this manner showed nothing but cotton fiber.

III. DYES

Less than a fourth of the total number of textiles show color. This is because plain weave cloth, which

[36] Fineness of thread does relate to the size of the spindle. O'Neale found in her study of modern Guatemalan Indian weaving that: "Spindles of various sizes to produce different sizes of yarns are a necessity" (O'Neale, 1945: p. 10).

[37] Kidder and Guernsey, 1919: 113.

[38] Cosgrove, 1947: 68; Kidder and Guernsey, 1919: 113; Martin *et al.*, 1952: 206–211. The latter reference gives considerable information regarding direction of twist in spinning and plying.

[39] Kelly, n.d., These were not seen by me.

[40] Amsden, 1949: pl. 3.

makes up the bulk of the collections, was generally woven of natural color white thread, and left undecorated.

There is considerable difficulty in accurately identifying textile dye colors. Sometimes, for instance, it is impossible to tell whether color is due to accidental staining or intentional dyeing, and there is always the probability of fading, so that the original hue remains somewhat a matter of guesswork. Certain of the yellows may once have been brown, and some of the dark browns might have been black. Light browns, yellows, and pale reddish-orange tints may be natural fiber colors. In spite of these difficulties eight colors may be distinguished. These are, in order of frequency of use: brown (90); red (75); black (50); blue-gray (12); yellow (10); dark blue-green (3); green (2); and dark blue-black (2). The numbers are approximate, as they do not include the many examples of dyed thread. They do indicate, however, the relative importance of the colors. The incidence of black, brown, and red is markedly high, partly because these are the three colors used in Anasazi stripe twill (pp. 563–565) cloth, which is well represented in the collections. Figuring without these twills, brown would still be easily the most important color, appearing in about 75 cases. Red would be next with approximately 47 occurrences, and black third with 46.

Red, brown, black, yellow, and blue-gray were probably used in all weaving centers, although the latter two have not so far been reported from the Rio Grande. The green found on Painted Cave textiles is not duplicated in material from any other site. Pale green thread was found in Winchester Cave and dark blue and blue-green have been observed on cloth from Tonto.

Color was applied to textiles in several ways, the most common method being to dye the thread before it was woven. Cloth was sometimes dyed after it was removed from the loom—a fact proven by the existence of the tie-dye specimens. Finally, a design might be painted on woven cloth with a brush. Color is rarely found in non-loom fabrics. Exceptions are: the counterpaired warp-twine tie from Tonto (pp. 579–583); a net from McEuen Cave containing four shades of brown thread (p. 591); a four-strand braid from Canyon Creek, in which two strands are brown and two white (Appendix C, chart 12); a flat braid from Mule Creek Cave fashioned from red threads (Appendix C, chart 12); the yellow fringe of a child's skirt from Tonto (p. 616); a red skein of threads, probably a breech clout, from Tularosa Canyon (pp. 616–617); the turban from Hidden House, composed of various shades of brown threads (p. 619); the black cylindrical twill sacks from Tonto and Sunflower Cave (pp. 583–586), and various cords and strings. Tapestry bands, though not generally true loom products, are included with loom-woven cloth in the following discussion.

Convention apparently operated strongly in dictating the use of certain colors or color combinations for particular weave or decorative techniques (table 2). Brown or black and white warps and/or wefts were traditional for warp- and weft-float pattern weaves, warp and weft stripe cloths; brocaded plain weaves, and brocaded twills. This combination was also used in a high percentage of other twills, and in checks and plaids. Other checks and plaids were woven with red and white warps and wefts. Anasazi twills always combined white warps with bands of white, red and brown or black wefts. Tapestries—plain weave and twill—consist generally of two colors of weft, plus white, woven on a framework of white warps. Weft color combinations include:

white—brown—red
white—black—red
white—brown—blue-gray
white—black—blue-gray
white—brown—yellow
white—black—yellow
white—brown—black
white—yellow (?)—blue

In other words, white and brown or black were the basic colors and to these was added either red, blue-gray or yellow. The single example of white—yellow—blue is a tump line from Wupatki. The yellow may be faded brown. There are two tapestries in which three colors of weft, plus white, appear. One is a narrow tie from Montezuma Castle with two shades of light brown plus red, and the other a tump line from Forbidding Canyon with black, yellow, and red wefts. (See Appendix C, chart 6.)

The only occurrence of four colors plus the white ground is on a painted blanket from Painted Cave, which combines brown, black, red, and green (fig. 86). Other white cloths were painted in: brown and yellow; brown, black, and green; or in single colors—black, red, or brown. Simple tie dye, of course, requires but one color, which contrasts with the white of the cloth to make the pattern. Black, brown, blue-gray, and yellow have been recorded for this technique. The decorative threads of *true* embroidery are most apt to be blue-gray and/or brown, although one piece was embroidered in dark blue-green. There is no instance of the use of blue and red together on a single cloth.

Very little has been done to determine the sources of prehistoric textile dyes in the Southwest. There are only two published reports to which we can refer. Neither pretends to be definitive, and the two are not in agreement, except in the case of red. In the earlier statement, by McGregor,[1] two classes of dyes were distinguished, organic and inorganic. The latter were said to be more common, and to consist of: "Red, produced from hematite or some other iron oxide; yellow,

[1] McGregor, 1931: 3–4.

TABLE 2

THE USES OF COLOR

Type of Fabric			Brown	Red	Black	Blue-Gray	Yellow	Dark Blue	Dark Blue-Green	Green
Plain weave cloth	Solid dye		X	X	X				X	
	Tie-dye		X		X	X	X			
	Painted		X	X	X		X			X
	Embroidered:	twine-stitch			X		X			
		running-stitch		X		X				
		"true"	X			X			X	
	Brocaded		X							
	Plaid pattern		X	X	X			X		
	Check pattern		X	X						
	Rag-wefts			X	X					
	Weft stripe		X							
	Warp stripe		X		X					
	Tapestry		X	X	X	X	X		X	
Floated weave cloth	Plain, reversed and diamond twills		X	X	X	X				
	Broken twills		X							
	Double-weft twill		X			X				
	Brocaded twill		X							
	Twill tapestry, interlocked wefts		X	X	X	X				
	Warp-float pattern weave		X							
	Weft-float pattern weave				X					
Weft-wrap openwork			X							
Counterpaired warp-twine								X		
Cylindrical warp weaves					X					
Netting			X							
Braid			X	X						
Cord, wrapped					X					
Thread and string			X	X	X	X	X	X	X	X

from yellow ochre; and blue or green, produced from copper sulphate" (*op. cit.*, 3). The only organic dyes identified were black, dark brown, and light blue More recently, spectographic analysis of pigment on one of the Painted Cave blankets was undertaken, and gave the following results:

Red: iron and manganese.

Green: iron and manganese (trace), copper absent. The main source of green appears to have been of vegetal origin.

Black: strong manganese, trace iron.[2]

[2] Haury, 1945*b*: 30.

TABLE 3

THE RANGE OF COLORS IN TEXTILES FROM THE MUSEUM OF NORTHERN ARIZONA AND TONTO NATIONAL MONUMENT

Some idea of the range in shades of brown, black, red, blue, green, and yellow to be found in prehistoric cotton textiles may be had from studying the first part of the accompanying table. Listed in the second part are shades noted on stained, scorched, or weathered fabrics which had originally been natural white cotton. These are included to demonstrate how difficult the task of distinguishing true dye may be. The table was compiled on the basis of fabrics and string in the Museum of Northern Arizona and at Tonto National Monument, except for the green (22. G 3). This was taken from the illustration of the Painted Cave blanket in Haury, 1945*b*: pl. 11. A chart of colors, matched against the actual specimens, was first prepared. This was then keyed, as nearly as possible, to color squares in Maerz and Paul, 1950.

PART 1. RANGE OF COLORS ON DYED OR PAINTED CLOTHS

Number of Maerz & Paul Color Square	Catalogue Number of Pieces Matched	Type of Textile	Chart Number in Appendix C
2. D 8	NPS-T 9/525	Plain weave	2
4. A 10	NPS-T 9/304 9/493	Rag-weft Plain weave	3, d 2
4. B 9	NPS-T 9/377	Plain weave	2
4. E 10	MNA 695/NA2519.M226A .381 .784	Cotton string[1] Cotton string Twill	— — 8, a
5. A 9	MNA 695/NA2519.466 NPS-T 9/79	Plain weave tapestry Plain weave	6 2
5. A 10	NPS-T 9/58 9/127 9/223 9/291 9/368	Plain weave Plain weave Plain weave Plain weave Cotton string	2 2 2 2 —
5. H 10	NPS-T no number	Plain weave tapestry	6
5. K 9	MNA 695/NA2519.381 .700	Cotton string Cotton string	— —
7. A 8	NPS-T 9/527	Plain weave	2
7. A 10	MNA 695/NA2519.M347	Twill with inlaid wefts	8, a
8. E 9	MNA 695/NA2519.381	Cotton string	—
9. C 5	NPS-T 9/472	Plain weave	2
9. C 6	NPS-T 9/439	Plain weave	2
10. E 5	MNA 695/NA2519.381	Cotton string	—
11. C 4	AMNH 14/224	Plain weave tapestry	6
11. D 4	MNA 696/NA746.1	Embroidered cloth	5, a
11. F 5	MNA 77/NA405.M233 NPS-T 9/102 9/151	Twill tapestry Plain weave Plain weave	8, a 2 2
11. F 4	MNA 77/NA405.M234	Plain weave tapestry	6
12. B 5	MNA 695/NA2519.759	Woman's apron	18
13. A 7	MNA 695/NA2519.M337	Brocaded weft-float or twill	8, a
13. A 9	NPS-T 9/72	Plain weave	2
13. B 7	MNA 695/NA2519.381	Cotton string	—
13. B 8	AMNH 14/224	Plain weave tapestry	6
13. D 9	NPS-T 9/174 R16–15	Plain weave Braiding around a core	2 12
14. C 7	MNA 1233/A1481	Diamond twill tapestry	8, a
15. A 8	NPS-T 9/207 R16–15	Warp-float pattern weave Braiding around a core	7, b 12
15. E 9	NPS-T 9/38 9/625	Plaid Plain weave	3, a 2
15. E 10	NPS-T 9/376	Plain weave, paired wefts	3, b
16. C 4	MNA 695/NA2519.381	Cotton string	—
22. G 3	Haury, 1945 *b*: pl. 11	Painted blanket	15
34. A 5	MNA 695/NA2519.295	Tie-dye	9, a
34. B 1	MNA 77/NA405.M233	Twill tapestry	8, a
36. A 4	NPS-T 9/483	Twill breech cloth	17
37. G 6	NPS-T 9/600	Counterpaired warp-twine	10, b
38. B 5	NPS-T Lower Ruin	Plaid	3, a
40. A 1	NPS-T 9/41 9/441 9/569	Plain weave tapestry Embroidered cloth Plain weave	6 5, a 2
45. A 6	MNA 77/NA405.M234	Plain weave tapestry	6
46. A 2	MNA 696/NA746.1	Embroidered cloth	5, a
48. A 1	NPS-T 9/376	Plain weave, paired wefts	3, b

PART 2. RANGE OF SHADES ON STAINED, SCORCHED OR WEATHERED CLOTHS

Number of Maerz & Paul Color Square	Catalogue Number of Pieces Matched	Type of Textile	Chart Number in Appendix C
3. A 7	MNA 696/NA746.1	Embroidered cloth	5, a
3. A 8	NPS-T 9/152	Plain weave	2
9. B 2	NPS-T 9/524 9/525	Plain weave Plain weave	2 2
10. B 2	MNA 1233/A1481 NPS-T 9/528	Diamond twill tapestry Plain weave	8, a 2
11. B 1	AMNH 14/224 MNA 77/NA405.M234 MNA 695/NA2519.759	Plain weave tapestry Plain weave tapestry Woman's apron	6 6 18
11. B 2	NPS-T 9/382	Plain weave	2
11. B 3	NPS-T 9/390	Plain weave	2
11. B 4	NPS-T 9/474	Plain weave	2
11. C 3	NPS-T 9/230	Plain weave	2
12. A 2	NPS-T 9/367	Plain weave	2
12. A 6	NPS-T 9/415	Plain weave	2
13. A 3	NPS-T 9/387	Plain weave	2
13. B 5	NPS-T 9/388 9/389	Plain weave Plain weave	2 2
13. D 7	NPS-T 9/83	Plain weave	2
14. B 5	NPS-T 9/668	Plain weave	2
14. B 6	NPS-T 9/74	Plain weave	2
15. A 6	NPS-T 9/354	Plain weave	2
42. A 1	MNA 77/NA405.M233	Twill tapestry	8, a

[1] Cotton string with the Museum of Northern Arizona catalogue number is from Kiet Siel.

A thorough analysis of Southwestern textile dyes remains to be done, and should be undertaken by a trained chemist in the manner followed by Dr. Michael Kasha in his study of colors in pre-Columbian Chihuahua fabrics.[3] Dr. Kasha found that the dyestuffs of

[3] O'Neale, 1948: 151–157.

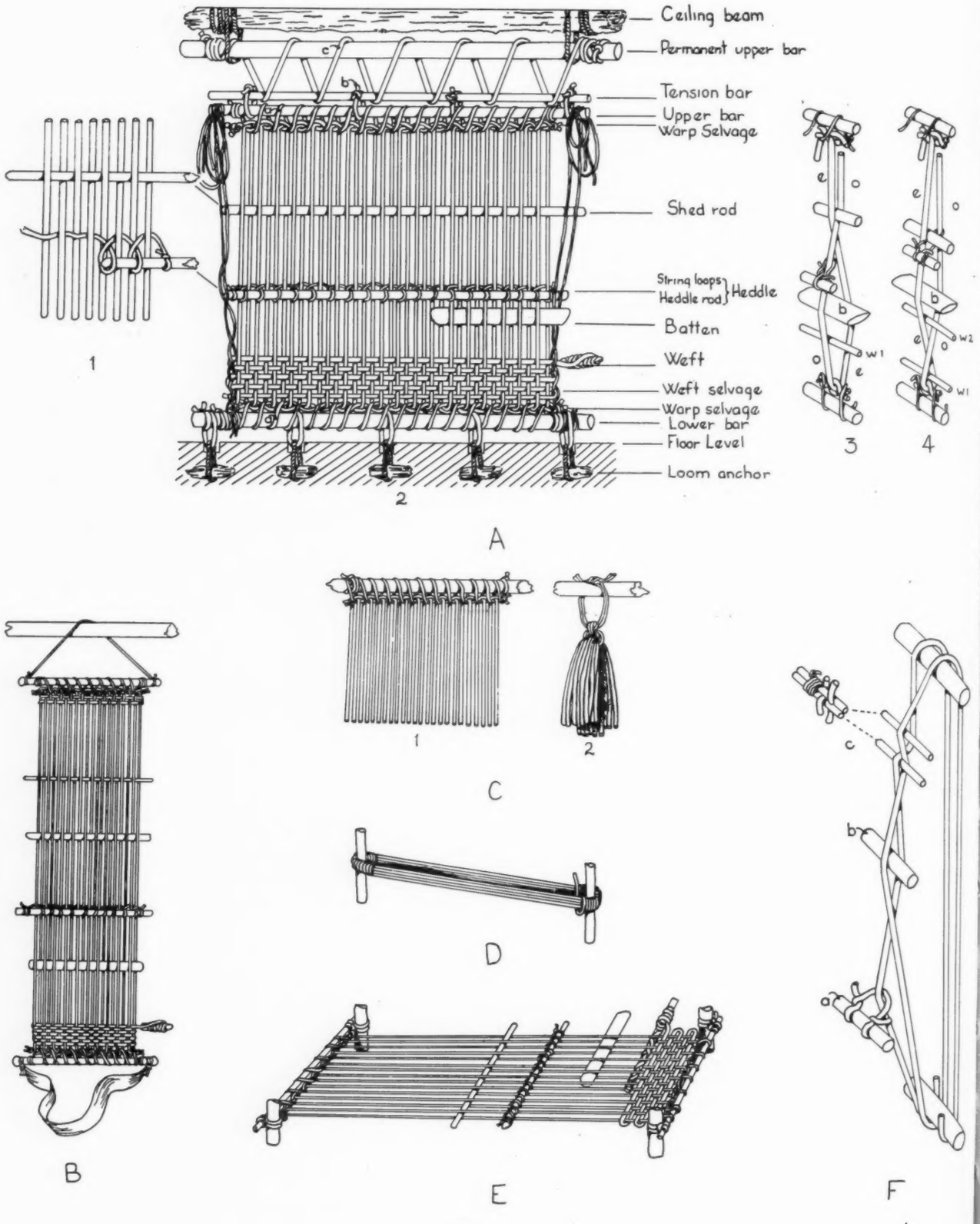
Ceiling beam
Permanent upper bar
Tension bar
Upper bar
Warp Selvage
Shed rod
String loops
Heddle rod
Heddle
Batten
Weft
Weft selvage
Warp selvage
Lower bar
Floor Level
Loom anchor
1
2
3
4
A
B
C
D
E
F

FIG. 7.

Chihuahua were exclusively of plant and mineral origin (as is apparently the case in the Southwest), in contrast to the insect and shellfish dyestuffs of lower Mexico. This he cites as evidence of a link in the material culture of the Southwest and northwestern Chihuahua. The dark blues and blue-green from Tonto might well prove to be plant indigo such as that found in the Chihuahua material. The dark brown in Southwestern textiles, whatever its source, tends to weaken the cotton fibers, as it is always this color thread which wears out of a cloth first. Natural brown cotton fibers do not have the survival qualities of white cotton, a fact which may also help to explain the deterioration of brown threads.

IV. LOOMS AND OTHER WEAVING APPARATUS

THE TRUE LOOM

A loom is a machine composed of two parallel bars between which warp threads are strung and held taut. Weft threads are woven back and forth across the warps from the lower bar up. Warps are divided into two or more sets, each set being controlled by a heddle. It is the heddle which distinguishes a true loom from a fixed-warp frame. In the latter the warps are anchored between two bars, but are manipulated individually with the fingers, a needle, or removable sticks.

Three types of two-bar looms have been used historically in the Southwest and were probably present in pre-Spanish times. These are: an upright or vertical loom; a belt, back-strap, or waist loom; and an horizontal loom. There are a number of excellent descriptions of these to which the reader interested in detail may refer.[1] We will give only the basic principles on which each operates.

FIG. 7.

A. The vertical loom, rigged for plain weave. (1) Detail showing the rigging of string loops to the heddle rod. (2) A diagram of the loom and its working parts. (3 and 4) Diagrams illustrating the functions of shed rod and heddle in changing sheds. Only two warps, *e* and *o*, are drawn in. These represent, respectively, the even-numbered and odd-numbered warps. The shed rod passes behind *e*—or behind all the even-numbered warps (2, 4, 6, 8, etc.). Heddle loops clasp *o*, or all odd-numbered warps. In diagram *3* the heddle is shown pulled forward, and the batten, *b*, inserted behind *o* and turned sideways to open the shed for the first weft, *w1*. In *4* the shed rod is shown forced down against the heddle loops, and the batten holding open the shed thus formed. The second weft, *w2*, is in position.
B. The belt loom.
C. Two methods of fastening threads for plaiting techniques. (1) Free-hanging threads strung along a stick or bar. (2) Free-hanging threads fastened at their centers to a single point.
D. Warp set-up for the finger-weaving of weft-twine or plain tapestry bands.
E. The horizontal loom.
F. Detail of tubular warp rig showing heddle, *a*, and shed rod, *b*, in position on the front plane. Two rods, *c*, are run over and under alternate warps (or groups of warps) and their ends, at both edges of the web, bound together. This keeps the warps from slipping out of position during weaving.

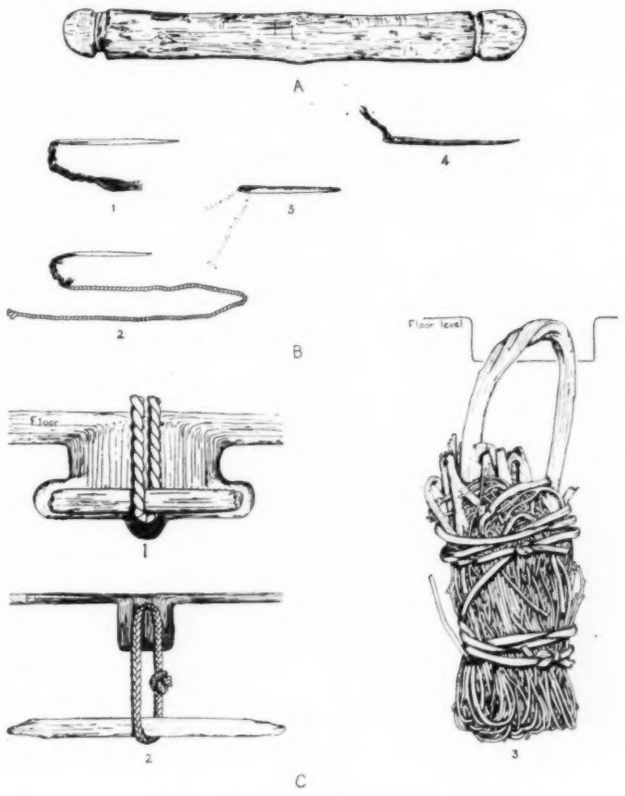

FIG. 8. Needles and loom parts.

A. Roller about 18″ long, probably one end stick for a belt loom. Kiet Siel. (MNA 695/NA2519.174.)
B. Needles (length of *4*, 2¾″). (1 and 2) Yucca leaf tip needles from northern Arizona. A bit of cotton thread remains attached to (2). (3) Needle made of a sliver of bird bone, with an eye drilled in the butt end. Pecos. (Kidder, 1932: fig. 188, f.) (4) Eyed needle made of a long, straight spine of the barrel cactus. (Haury *et al.*, 1950: pl. 38, *h*.)
C. Floor anchors for upright looms. (1) One of a series of five loom anchor holes found pecked into a sandstone ledge at a ruin on Laguna Creek ("The Cornfields"). (Kidder and Guernsey, 1919: fig. 26.) (2) Floor anchor in the kiva of Olla House. (Kidder and Guernsey, 1919: fig. 22.) (3) A common type of floor loop anchor. Tsegi Canyon. (MNA 712/NA2660.2.)

THE VERTICAL LOOM

The vertical loom (fig. 7, A) takes its name from the fact that the warps are at right angles to the ground, or in vertical position. Among the Pueblo Indians the upper loom bar is lashed to the roof beams, and remains permanently in that position. It is a heavy pole between six and eight feet long, and three to four inches thick. Directly below this, and in line with it, is the lower loom pole, fastened in position by ropes which

[1] See, in particular: Amsden, 1949: 31–48; Reichard, 1936: 49–80; Spier, 1933: 115–121.

FIG. 9. Loom anchor attached to clay plug. Length, 10". Painted Cave. (Photo by Amerind Foundation.)

run through loops set into the floor. Prehistoric loom loops are illustrated in figures 8, C and 9. Some were made by bending a slender, pliant stick into an inverted U. The two ends, together with such materials as old corn cobs or other small sticks, were lashed with fiber twine. This bulky object was set into a hole in the floor so that the curve of the stick formed a loop flush with the surface of the floor. The lump of material at the ends of the U, packed tightly in the mud beneath the floor, served to prevent the loop from pulling out (fig. 8, C, 3). Others were made by fastening yucca ropes or braids into holes in the floor (fig. 8, C, 1, 2).

Essential steps in rigging and using the vertical loom, as observed among the historic Hopi, are outlined below. This description should be supplemented by careful study of figure 7, A.

Warping

Two poles are set parallel to one another about six inches above the ground and as far apart as the desired length (warp stretch) of the finished fabric. These poles are supported by "loom blocks," which are chunks of sandstone roughly a foot square, each with a shallow depression or socket on one surface, into which pole ends will fit. There may be four loom blocks, two for each pole, or there may be only two. In the latter case each pole lies between a hole drilled in the wall of the room and a block.[2] The warp, a continuous thread, is wound about the poles figure-eight-wise.

Binding Warps to Loom Poles

A string, generally two- or three-ply, is twined between the loops of the warps along the outside of the warping poles. These will be the warp selvage cords of the finished cloth. Next, another pole is placed against one warping pole and a heavy cord is wrapped around it and beneath the twined string between each warp loop (fig. 7, A, 2, *a*). This same process is repeated at the other end of the warp set. Now the original warping frame poles may be removed, as the warp is bound securely at each end to the regular loom poles. Strings are fastened loosely between these poles at each edge of the warp. These are to be incorporated into the weave as side selvage cords. One loom pole is then fastened by rope loops (*b*) to a rod, the tension bar, which in turn is bound to the permanent upper loom beam. The second loom pole, now the lower bar, is held in position by ropes passed through the loom loops. Warp tension is regulated by adjusting the tension bar and rope binding (*c*) at the top of the loom.

Heddles and Shed Rod

Warps are separated and controlled by a shed rod and one or more heddles. The heddle consists of two parts: a string which loops about selected warps; and a slender stick to which the string loops are fastened (fig. 7, A, 1). This stick lies in front of the warps and extends slightly beyond each edge of the web. In plain weave every other warp is fastened to it. When the weaver pulls the heddle towards himself these warps are brought forward, and the weft can be passed behind them, between them and the opposite set of warps. This second set is controlled by the shed rod, which rests in position behind them and in front of the heddle-controlled warps. After the heddle is released, the

[2] See also MacLeish, 1940: 297–299.

shed rod is brought down close against the string loops. The shed-rod-controlled warps are automatically pushed forward, the heddle-controlled warps backward. The second pick of weft may be inserted in the space between them. The space formed when one set of warps is pulled away from the other, is called a shed. Basic steps in plain weaving are shown in figure 7, A, 3 and 4.

Some weaves require several heddles, each of which governs a particular set of warp threads. A heddle may be removed at any time and the warps re-strung in different sets, so that a new pattern will be produced in weaving. This gives the native loom a flexibility not found in the hand loom of white weavers.

Weaving Tools

Only two weaving tools are employed—a "comb" and a batten, or weaving sword. Until recently the comb consisted of a narrow, flattened piece of wood with a row of pointed teeth along one end (fig. 3, D). It has been replaced by an ordinary kitchen fork. The batten is a smooth, sword-shaped implement varying in length from eight to thirty inches and between one and three inches wide. It is generally rounded at both ends, and a fairly sharp edge is given to one or both sides (fig. 3, E). For convenience in handling, the weft is wound into a small ball, or, sometimes, twisted about a stick, six to eight inches long. There is no specialized shuttle.

Basic Steps in Weaving

The weaver sits on the ground in front of the loom. He opens a shed by pulling forward on a heddle or forcing the shed rod down, and inserts the batten. The shed is held open by turning the batten sideways, and the weaver draws the weft through from one edge of the web to the other. The weft is forced down into position by a few deft strokes of the comb, and beaten close against the preceding pick with the edge of the batten. The batten is then removed, another heddle or the shed rod is used to open a second shed, and the weft is carried back through this. After each passage through the web, the weft is drawn between the side selvage strings. These are twisted a half-turn about each other between weft picks. The successive twists shorten the span of the strings and from time to time they must be released from the upper loom pole and let down a bit. Short battens are used for narrow fabrics and long battens for large blankets. However, there are no battens as long as the width of the ordinary blanket. Therefore, in weaving a large cloth the batten is withdrawn and re-inserted three or four times for each pick of weft.

A measuring stick or tenter (fig. 3, F) may be used to help regulate the width of the web. This is a flat stick about an inch wide with grooves marked across it at set intervals against which the spacing of warps may be checked. It is fastened by each end to the outer warp threads, and lies behind the web. The upper loom pole is lowered, when necessary, to keep the work area within easy range of the weaver, the completed section of cloth being folded and sewed against itself. Sometimes a band of material is woven at the lower pole, the warps are turned "upside down" and a band woven at the other end. The center is filled in last. The final few weft picks in the center of the web or at the upper edge, as the case may be, are difficult to insert. To accomplish this step the weft thread is fastened to a sinew thread loop near one end of a very slender stick about 12 to 18 inches long (fig. 2, B). This stick, called the "finishing needle," is worked laboriously through the warps. Nowadays the final weft or two may be put in with the aid of a steel needle.

THE BELT LOOM

The belt loom is also called a waist, stick, or backstrap loom. It consists simply of two short rods about 18 to 28 inches long, to which the warps are bound in the same manner as for the vertical loom (fig. 7, B). One rod is fastened to a strap, or rope, which runs about the weaver's waist as he sits on the ground. The other is usually tied to a tree, house wall, or other convenient support at about the level of the weaver's shoulders, so that warps lie oblique to the ground. Sometimes (as formerly among the Hopi) the far end is held by the feet, the warps thus lying horizontal to the ground, just above the outstretched legs. Weaving proceeds upward, or away from the worker. There is no tension pole, warp stretch being governed by the pull of the body. Warp sets are controlled by heddles and shed rod as in the case of the vertical loom, and the general principles of operation are the same. The reed heddle, sometimes found with the belt loom, is a Spanish introduction for which there is no archaeological evidence in the New World.

TUBULAR WARP WEAVE

Before describing the third loom type, we must explain the practice of weaving on a tubular warp, which, in the Southwest, is used to make the same type of narrow textile (warp-face belts and bands) as that produced on the belt loom. In this case the warp is not bound to the loom sticks, but is passed continuously about them so that it can be pulled around like a roller towel and the working area kept within easy reach (fig. 7, F). The Hopi and Zuni fasten one "roller" to the upper beam of the regular vertical loom and the other to the floor anchor loops. The Navaho either fasten the rollers to a movable frame, or handle them as they do the belt loom.[3] Heddles, shed rod, batten, and end sticks resemble those used in belt loom weaving.

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[3] Amsden, 1949, pls. 19, 20; MacLeish, 1940: 300–302; Spier, 1924: 74.

THE HORIZONTAL LOOM

In the horizontal loom warps lie parallel to the ground (fig. 7, E). The following description of this loom among the Maricopa is given by Spier:

> The ground where the loom was to be erected was first prepared by spreading clean sand over it, or by sprinkling water, beating it hard and sweeping it. . . . Four stakes three inches in diameter and eighteen inches long, were driven six inches into the ground. Warp bars were bound near the top of the stakes with willow twigs. Both stakes and bars were prepared from the tough inner wood of the giant cactus. . . .
>
> The warps were fastened together at each end by a string twined through them close to the warp bar, so that the whole set of warps could be lifted as a unit from the warp bars. The warp bars were then replaced to serve as loom bars, to which the warp was bound by a cord running about the loom bar and the previously-mentioned twined string.[4]

The warps were laid up in figure-eight fashion. Apparently a single heddle and shed rod controlled them, the only technique used historically for wide fabrics being a simple plain weave. The shuttle was a smooth arroweed stick as long as the width of the blanket and flat at one end. The weft was wound from one end to the other in a slightly spiral fashion. It passed twice around the stick at one end before returning to the other. As more weft yarn was needed the free end of a full shuttle was tied to the weft already in place.

Each pick of weft was beaten home with a weaving sword of mesquite wood. A pointed stick about six inches long was inserted between warps to push weft picks into position, instead of the weaving comb of the northern Pueblos. No tenter was used to keep the warps evenly spaced, and there were no edge selvage cords. (The latter does not seem to have been true of the Pima.) Weaving was carried on from one loom bar towards the center as far as possible, then from the other bar inward. The unpicked center space was then filled in with weft yarns attached to a very slender, pointed stick. According to Bartlett [5] the Pima weaver worked towards the center until he had difficulty reaching his weft, then sat on the finished portion of the web to continue weaving.

The fastening of warps directly to loom poles, with no tension pole or rope at the far end, was noted also in the case of the belt loom.

THE PRESENT DISTRIBUTION OF LOOM TYPES IN THE SOUTHWEST AND FABRICS WOVEN ON EACH

Here, then, are the three aboriginal looms of the Southwest—vertical, belt, and horizontal—together with the tubular warp rig which can be used on all of them. Nearly all modern Pueblo textiles are woven on the vertical loom. Even warp-face belting, so closely correlated with the belt loom in most New World weaving centers, and a belt-loom product among the Puebloans in the earlier decades of this century, is usually woven today on the vertical loom with a tubular warp rig. Apart from the belting, products of this loom are markedly weft-face (see p. 656), in contrast to the predominantly warp-face fabrics of Peru. Crawford was struck by this feature,[6] and one who has studied Pueblo fabrics will tend at first to confuse warps and wefts when handling Peruvian material. There may be a correlation between weft-face cloth and vertical-loom weaving in the Southwest, and warp-face cloth and belt-loom weaving in Peru.

The restricted use of the belt loom in the Southwest historically is interesting in view of the fact that this is the basic loom type in central and southern Mexico, Central America, and Peru. The only textile woven on it among the modern Pueblos, so far as I know, was warp-patterned belting. The Hopi discarded the belt loom thirty years ago, and it was losing favor at Zuni and in the Rio Grande Pueblos at that time. There is no record of its use historically in southern Arizona.

The horizontal loom was used until recently by the Papago, Pima, and Maricopa, and is found among the Tarahumare, Opata, and Yaqui-Mayo.[7] There does not appear to be any distinctive horizontal-loom product. The three known Pima blankets resemble the plain weave white cotton wedding blankets of the Hopi, except for their dimensions. The Pima cloths are longer than they are wide. Pima and Maricopa also wove warp-face bands on these looms, winding the warps figure-eight-wise, directly over the end bars, with no warp selvage strings.

Among the Pueblo people looms are usually operated by the men, except at Zuni, where women do most of the weaving. This may be a recent development, as the Zuni men are thoroughly familiar with the process. Looms are set up in kivas, or in a weaver's home. Old men were the blanket weavers among the Pima and Maricopa. Pima men also wove the belting, but this was done by women of the Maricopa tribe, who wanted it for cradle bands.

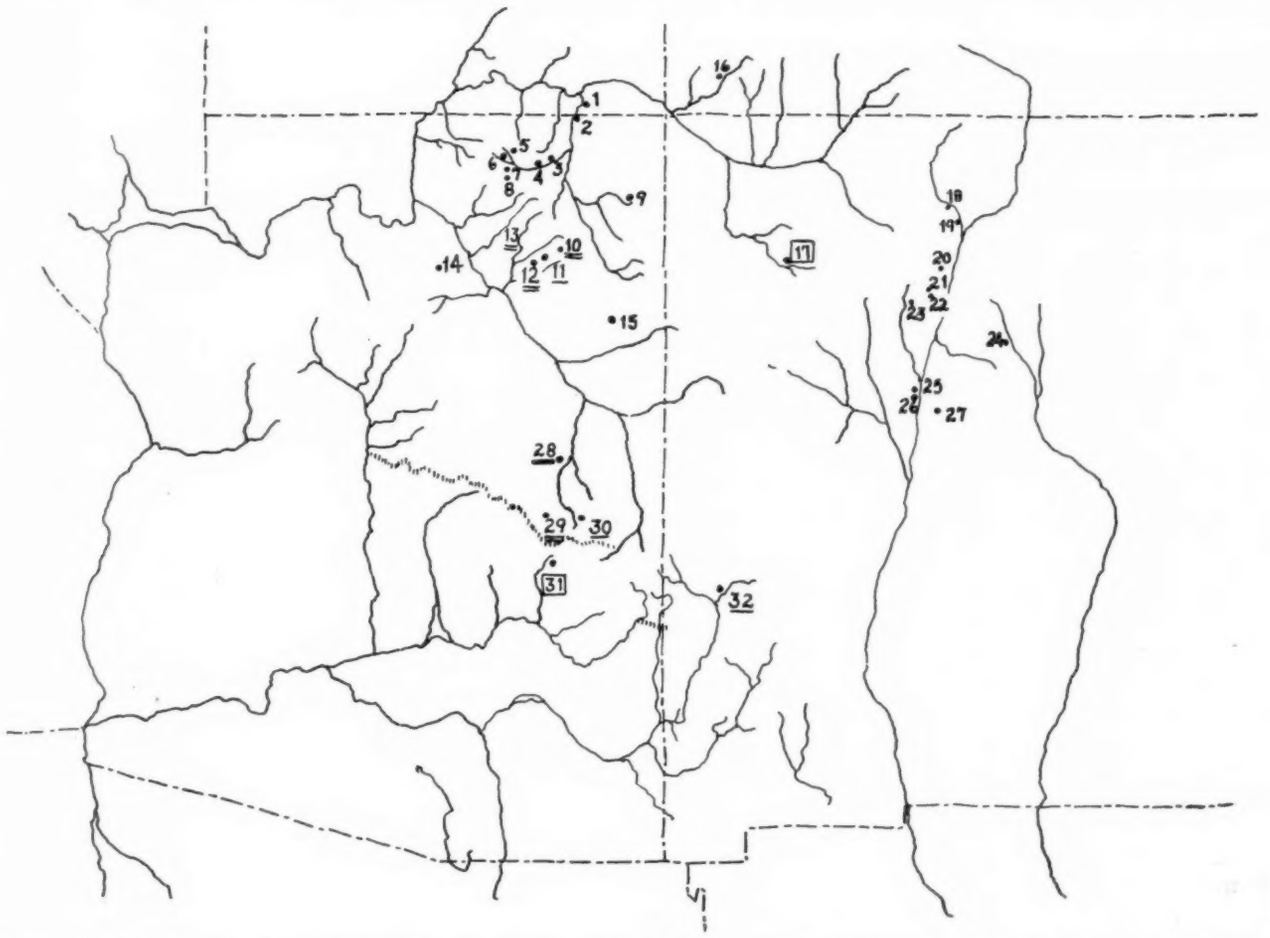
ARCHAEOLOGICAL EVIDENCES OF THE LOOM

From the preceding discussion it should be clear that there are various loom parts and associated implements which might survive in archaeological sites as evidence of loom weaving. Large loom poles, heddles, and shed rods, more or less unspecialized in form, could not be easily identified as such. However, floor anchor loops, stone warping-frame blocks, belt loom "rollers," combs, tenters, battens, and finishing needles are readily recognized, and their presence at a number of sites has been recorded.

THE VERTICAL LOOM

Anchor loops for the attachment of the lower bar of the vertical loom are reported in the floors of kivas

[4] Spier, 1933: 119–120.
[5] Bartlett, 1854: 224–226.
[6] Crawford, 1915: 98.
[7] Bennett and Zingg, 1935: 91–94; Spier, 1933: 115.



MAP 1. The distribution of loom anchor holes and sandstone warping blocks. (Sites containing loom holes alone are not underlined. Sites with both loom holes and warping blocks are underlined twice. Sites yielding warping blocks alone are underlined once. Numbers *17* and *31* are boxed, since the identification of floor features in them as loom anchor holes is doubtful.) (1) Poncho House. (2) Waterfall Ruin. (3) Laguna Creek, "Cornfields." (4) Olla House. (5) Kiet Siel. (6) Tsegi Canyon, Cave 2. (7) Betatakin. (8) Marsh Pass, Cliff House #8. (9) Painted Cave. (10) Kokopnyama. (11) Kawaika-a. (12) Awatovi. (13) Hopi villages, modern. (14) Juniper Terrace. (15) Kintiel. (16) Mesa Verde. (17) Tseh So. (18) Poshu. (19) Te'ewi. (20) Puyé. (21) Tyuonyi. (22) Frijoles Canyon. (23) Unshagi. (24) Pecos. (25) Kuaua. (26) Puaray. (27) Paa-ko. (28) Four Mile Ruin. (29) Pinedale. (30) Showlow. (31) Bear Ruin. (32) Delgar Ruin.

(or, less frequently, living rooms) in twenty-four sites (map #1). Floor features in the kivas at Tseh So in Chaco Canyon, and at Bear Ruin, tentatively identified as loom anchor holes in archaeological reports, are not included in this number. Judging from the general distribution of floor loops, it appears that their presence at Bear Ruin (600–800) would be way out of line. The twenty-four well-established occurrences are all Pueblo III or IV in date, and are from Anasazi villages with the exception of Juniper Terrace and Pinedale. The site in which loops were found at Juniper Terrace shows strong influences from the Kayenta area.[8]

Modern adjuncts of the vertical loom in the Hopi country are the sandstone warping blocks used in winding the warp before it is placed on the loom (p. 484). (Since these blocks are also employed by the Hopi as supports for end rollers in the "frame braiding" of a wedding sash,[9] and could very well serve to hold the bars of a horizontal loom, their presence alone in a site does not necessarily *prove* that a vertical loom was also used there.) Warping blocks have a very limited distribution.[10] They are reported from Showlow, Pinedale, and Four Mile Ruin, all Pueblo IV sites in the Little Colorado drainage just above the Mogollon Rim; and from sixty miles to the east of these sites at Delgar Ruin on the Tularosa River. Delgar Ruin is thought to be Middle or Late Pueblo III in date. Warping blocks first appear in the Hopi country in Pueblo IV, undoubtedly as the result of southern contacts. They have not been used historically any place except among

[8] Colton, 1946: 152–155.

[9] Kent, 1940.

[10] Woodbury, 1954: 153–157.

the Hopi, so far as is known. Floor loops for the vertical loom accompany warping blocks except at Kawaika-a, Four Mile Ruin, Showlow, and Delgar Ruin. There is little doubt that this loom was used at the first three of these, since it was present in contemporary neighboring villages. Its use in Tularosa Canyon in Pueblo III remains to be established.

Indirect evidence of the vertical loom is to be found in the size and appearance of complete prehistoric blankets, which are essentially the same as modern Pueblo examples woven on it.[11] Blankets are three to five and a half feet wide—dimensions way out of line for a belt-loom cloth, the width of which is governed by the weaver's reach. There is a hint of the widespread use of the vertical loom, also, in the fact that the blankets and, with few exceptions, other prehistoric textiles, are weft-face. Complete, or nearly complete, wide weft-face blankets come from Anasazi, Sinagua, and Salado Pueblo III and IV sites.

The vertical loom, then, was definitely the basic form among the Anasazi after 1100, and may well have been used by Sinagua and Salado. Evidence for the latter is indirect, since no loom attachments have been reported for Verde or Salt River Valley sites. The wide stationary loom used in Sinagua and Salado towns—whether vertical or horizontal—must have been erected outside the dwellings.

THE BELT LOOM

The distribution of the belt loom in the Southwest is not well documented, although there is evidence that it was known to Hohokam and Pueblo alike *at least* after 1000. Short loom end sticks almost identical to those currently used in southern Mexico and Guatemala in belt loom weaving were found at Pueblo Bonito and Kiet Siel, and battens around eight inches in length are recorded from Canyon Creek, Kiet Siel, and Chaco Canyon (fig. 8, A; fig. 3, E). Paired withe loops set into kiva walls are common at Mesa Verde. Usually they are just below the banquette, so that they are two to three feet above the floor. The two loops of a pair are from fifteen to twenty-four inches apart. Their position suggests that they served as anchor points for one end-bar of a belt loom.[12] There are a great many narrow cloths in the collections, but these may as well be products of the vertical or horizontal loom as of the belt loom.

Warp-face belting and specialized bead-type spindle whorls are associated with the belt loom in central Mexico, Guatemala, and Peru. They are found in Hohokam and Hohokam-influenced villages after 1000, and certainly suggest that the belt loom might also have been present. The warp-face blanket from Ventana Cave made of two fifteen-inch wide cloths sewn together, resembles belt loom work (Appendix C, chart 15).

THE HORIZONTAL LOOM

There is no archaeological evidence of the horizontal loom, nor is there apt to be, as the parts are unspecialized. However, the presence of the horizontal loom in northern Mexico and southern Arizona at the time of the first European contacts is at least an indication that this form was known in earlier, prehistoric periods. The wide, plain weave blankets from Ventana Cave are sufficiently different from typical Pueblo blankets to give substance to the belief that they were not woven on a regular Pueblo upright loom (pp. 605–606). Since they are too wide for the belt loom we may postulate that they are horizontal loom products.

THE THEORETICAL ORIGIN OF LOOMS IN THE SOUTHWEST

The belt loom unquestionably represents an introduction from the south. There are illustrations of it in the Mexican codices, and it was the basic form in prehistoric Peru. It was probably widespread in the intervening regions prehistorically, as it is at the present time. Beals, however, did not find references to it in historical sources on northern Mexico.[13] By early historic times the horizontal loom was the type widely used there for weaving bast fiber, and later, when it became available, wool. In southern Arizona cotton blankets and narrow belting were woven on such a loom until about 1900. O'Neale points out that the wide apocynum cloth blankets from pre-pottery sites in Chihuahua must have been woven on a stationary frame.[14] The rig used for these fiber cloths may have been a horizontal fixed-warp weaving frame, present in the area before the introduction of cotton. The string-loop heddle, introduced perhaps as part of the belt loom, when affixed to this frame, converted it into a true loom. In this form it survived into historic times south of the Mogollon Rim.

The origin of the vertical loom is something of a mystery. There is no evidence that it existed in Mexico or Peru prehistorically. It may have been developed by the Pueblo Indians through the addition of the string-loop heddle to an upright fixed-warp frame in use among them before the introduction of cotton or a loom. It is also possible that when cotton weaving became a kiva activity among the Pueblo Indians, they devised the idea of setting the wide horizontal loom upright so that it would fit into a limited space.

In short, it seems likely that the belt loom was the first true loom, that is, the first weaving apparatus equipped with an effective heddle, in the New World, and that this was the form diffused with the cotton

[11] This statement does not refer to rugs currently woven to meet demands of the tourist market, but to native style blankets, which are described on pp. 605–607. Prehistoric blankets are listed in chart 15, Appendix C.

[12] This information was given me by Mr. Don Watson, Park Archaeologist at Mesa Verde, in correspondence March 3, 1954.

[13] Beals, 1932: 106.

[14] O'Neale, 1948: 119.

plant from northern Peru. While it may not have been accepted *in toto* in certain areas, the idea of the string-loop heddle was borrowed from it. In the Southwest the belt loom was adopted for narrow cloths, at least to some extent, perhaps around 700 or even earlier. Heddles were also applied to wide, stationary frames—horizontal in southern Arizona, and vertical in the Pueblo area—which were already in use for the manufacture of fiber cloth. By early historic times the belt loom had been discarded in favor of the horizontal loom by weavers in southern Arizona and northern Mexico. The vertical loom has nearly supplanted the belt loom among the Puebloans today and may always have been the basic form north of the Mogollon Rim.[15]

OTHER WEAVING RIGS

Several methods of producing cotton fabrics, other than by true loom weaving, were used in the Southwest. These include: weaving on a fixed-warp frame; weaving on a skein of warps wound between two supports; braiding with warps wound tubular fashion between two rollers, or end sticks; braiding, or otherwise intertwining free-hanging threads; and looping. With the possible exception of tubular braiding, these were processes used in handling *fiber* thread before the introduction of cotton. They were not discarded after cotton weaving commenced, but continued to be employed to some extent until the coming of the Spanish. Each method is explained in the text in the course of describing the fabrics associated with it (see also fig. 7, C and D).

NEEDLES

The needle is, of course, a device primarily used in sewing, rather than weaving. The type most commonly found in prehistoric sites was made from the spiney tip of a narrow-leaf yucca leaf. The leaf was macerated, and the outer covering of pulp removed so as to free the fibers to within a couple of inches of the tip. These fibers were then twisted into string. In "threading" the needle one end of a cotton thread was twisted into the fibers at the free end of the yucca string (fig. 8, B, 1, 2). This kind of needle has been found in Anasazi sites, at Canyon Creek, Ventana Cave, and Tularosa Cave. A needle with an eye was also found at Ventana Cave (fig. 8, B, 4). It was made from the straight spine of the barrel cactus, two and three-quarters inches long, smoothed and polished.[16] Wooden and bird bone needles have been used in historic times by Puebloans in embroidering their garments. Both these types may have been known prehistorically, although I find no record of wooden needles. Fifteen bone needles were found at Pecos in both prehistoric and early historic levels. These are described as delicate slivers, usually of bird bone, with long, tapering points, and an eye bored near the butt end. They are from two to four and a half inches long (fig. 8, B, 3). Similar needles were found at Hawikuh.[17]

[15] My conclusions, though arrived at independently, are basically similar to Amsden's ideas on the origin of belt and vertical looms in the Southwest. Amsden, 1949, pp. 23–26.

[16] Haury *et al.*, 1950: 426–427, pl. 38, *h*.

V. A DESCRIPTION OF THE FABRICS

INTRODUCTION

The following chapter describing the various fabrics is divided into three parts: Part I, Loom-woven Cloth and Certain Closely Associated Techniques; Part II, Non-loom Fabrics Having Warps and Wefts; Part III, Fabrics Made Up of Single Elements.

Included with loom-woven cloth in Part I are certain plain weave tapestry bands which may, in point of fact, not have been constructed on the loom. They are described here because of obvious technical relationships to other loom-woven plain weave and twill tapestries. Painting, tie-dye and embroidery, decorative techniques which are found on loom-woven cloth, are also placed in Part I, as are descriptions of selvages, fringes, and sewing processes.

PART I. LOOM-WOVEN CLOTH AND CERTAIN CLOSELY ASSOCIATED TECHNIQUES

PLAIN WEAVE

Definition

A plain weave is one in which single weft threads interlace over and under single warp threads.

Technical Description

About 540 fragments, over half the total number of textiles studied, are classed as simple plain weaves (Appendix C, chart 2, *a*) having no distinguishing features other than, possibly, dye color, a warp or weft selvage, an occasional seam, darn, or patch. This number does not include complete articles of plain weave, such as blankets, ponchos, kilts, breech cloths, and bags, or cloths decorated with tie-dye, embroidery, or painting. Such pieces are given more detailed treatment in separate sections.

Plain weaving was done on the loom with the aid of one heddle and a shed rod. In this weave the heddle controls one set of alternate warps, as numbers 1, 3, 5, 7, etc., while the shed rod controls the second set, or numbers 2, 4, 6, 8, etc. Heddle and shed rod are pulled forward alternately for each succeeding pick of weft (fig. 10, A).

Virtually all the plain weaves are woven from single-ply Z-spun thread (fig. 6, A, 2). Warps in a given piece generally show more twists per inch and are finer in diameter than wefts, so that it is nearly always possible to distinguish between the two. In contemporary Pueblo cotton cloth a similar distinction is found, and is due to the fact that warpage is more tightly spun than weftage. A finer warp diameter can also result from the tension to which warp threads are

[17] Kidder, 1932: 222–225, fig. 188, *a–f*.

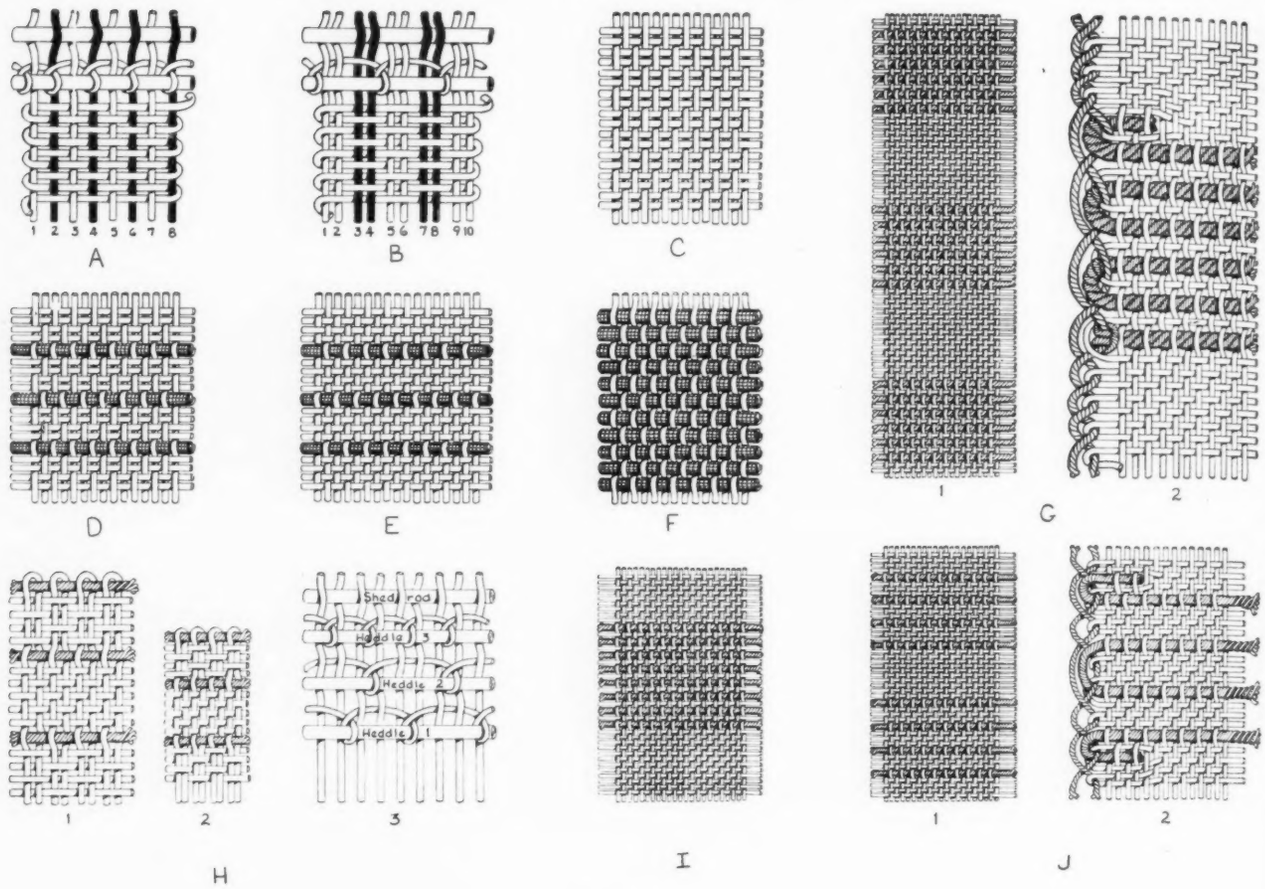


FIG. 10.

A. Heddle rig for plain weave.
B. Heddle rig for half-basket weave with paired warps.
C. Half-basket weave with paired wefts.
D. Rag-weft, cotton rag strips and paired wefts.
E. Rag-weft, cotton rag strips and single wefts.
F. Rag-weft with weftage consisting entirely of cotton rag strips.
G. Plain weave with heavy string wefts. Floating House. (PM 33–62–10/2005.) (1) Grouping of heavy wefts into bands. (2) Selvage detail.
H. "Eccentric plain weave." Tonto. (NPS–T 9/28.) (1) Threads widely separated to show their distribution. (2) Threads closed. (3) Possible heddle rig with heddles 1 and 2 controlling paired warps and heddle 3 and the shed rod controlling warps for over-one under-one weave.
I. Plain weave with heavy string wefts. Provenience unknown. (ASM 5408.)
J. Plain weave with heavy string wefts. White House. (AMNH 29.1/7897a.) (1) Distribution of string wefts. (2) Selvage detail.

subjected on the loom. Thread from a single ball of yarn may be used for both warp and weft, but the former will appear to be thinner in the finished web. Thus, although a single continuous yarn was used in weaving the small rectangular cloths called "sacred cigaret sashes" (pp. 619–621), warp and weft are readily distinguished.[1]

A guide to fineness of weave is furnished by counting the number of warp and weft threads to the inch. The usual plain weave has a count of twenty to thirty threads. This count is either square—that is, there are an equal number of warps and wefts in an inch—or warps slightly outnumber wefts. The comparatively softer, thicker wefts, even when they do number less, tend to fill out over the warps, giving the cloth a weft-face appearance. They are apt to wear out of the fabric first, leaving a skeleton of warps.

A few cloths are remarkable for being much more closely woven than the average. Conspicuously high thread counts occur in the following fragments:

Camp Verde (ASM ?V-6)	52 warps, 48 wefts
Canyon Creek (Haury, 1934, p. 89)	50 warps, 40 wefts
Painted Cave (AF-A2341)	45 warps, 45 wefts
Southeastern Utah (UM 29.43.359)	52 warps, 47 wefts
Tonto Monument (NPS-T 9/527)	42 warps, 34 wefts
Wupatki Monument (MNA 693/405R7.6)	53 warps, 53 wefts

[1] Spier (1924: 68–69) noted that warps and wefts of Zuni wool blankets are of different widths, although supposedly taken from the same ball of yarn.

The Uses of Plain Weave Cloth

Plain weave, the simplest of loom processes, was a practical, relatively rapid means of weaving large articles. It was used especially in making blankets, shirts or poncho-like garments, kilts, broad sashes, and breech cloths. Pieces of plain weave cloth were also sewed together to make small bags. A complete rectangular plain weave cloth, 8 × 5⅜ inches, was found in Bat Cave, Catalina Mountains (p. 618, fig. 121). Most of the miniature cigaret "sashes" or "blankets" are plain weave (pp. 619–621).

The Distribution and History of Plain Weaves

The earliest dated plain weave cotton cloths come from a cave in the middle branch of the Tsegi. Found with a Pueblo I burial were a number of fragments, all parts of blankets or clothing wrapped about the mummy, and a sleeve-like article (fig. 126, C).[2] One fragment is dyed black, and another is the brown and white check described on page 493 (fig. 11, D). Other early plain weaves include one fragment from Floating House Ruin (Pueblo I or II), two from Pueblo II sites in the San Francisco Mountain area near Flagstaff,[3] and two from Los Guanacos (A.D. 700–900).[4] Plain weave cotton cloth was found in Tularosa Cave in all levels from 700 to 1200.[5]

These finds establish the presence of loom-woven plain weave cotton cloth in the Southwest generally by at least 700.[6] Cloth-impressed sherds from the Georgetown Phase (500–700) in Tularosa Cave indicate that loom weaving may have been practiced there somewhat earlier than Pueblo I. The cloth represented may, of course, have been bast rather than cotton. Plain weave fiber cloths have been found in Basketmaker II sites in the Kayenta region [7] and in Chihuahua.[8] These are technically unlike the cotton or fiber plain weaves of 700 and after, and may have been woven by different methods. (See Appendix A, p. 658, for a discussion of bast fiber fabrics.)

There is really nothing to distinguish early plain weave cottons from those of Pueblo III and IV. Indeed, with the exception of the Ventana Cave series, plain weaves are alike in appearance regardless from what period, site or region they come. A marked tendency towards warp-face fabrics distinguishes the Ventana fragments, warps far outnumbering wefts in a high percentage of cases (Appendix C, chart 2, *a*). From Arizona and New Mexico south to Chile, wherever hand loom weaving is still done, the simple, basic technique of plain weave is important. Such a condition must have obtained prehistorically also.

[2] Guernsey, 1931: 8–9; 97. See "Tsegi Canyon, Cave 1, Middle Branch" in Appendix B, chart 1, for a complete list of textile finds with this burial.

[3] Bartlett, 1934: 46–47.

[4] Haury, 1945*a*: 179.

[5] Martin *et al.*, 1952: 299.

[6] According to the Peabody Museum accession books, a piece of cotton cloth, #A5597, was found in 1922 in Broken Roof Cave, Tsegi Canyon, in a burial cist with an atlatl and other Basketmaker-like artifacts. This fragment could not be located in the Museum when I was there in July, 1946, and is not mentioned in Guernsey's account of the cave (Guernsey, 1931: 37–40).

[7] Guernsey and Kidder, 1921: 63–65.

[8] O'Neale, 1948.

PLAIN WEAVE, VARIATIONS

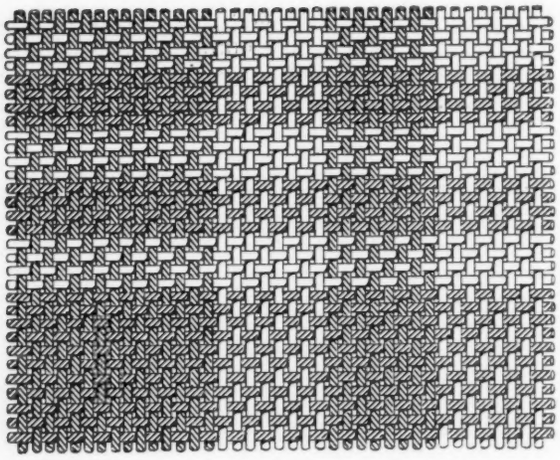
Introduction

There are certain textiles which, while structurally plain weaves, woven on a loom rigged with one heddle and a shed rod, differ in appearance from the great body of fabrics just described. Such variations may be due to: the use of colored warp or weft stripes, singly or in combination; pairing of warps or wefts; the substitution of heavy string for regular weft threads; the use of rag strips for weftage and of fiber thread for warp, weft, or both; the dominance of warp over wefts which results in warp-face cloth, or rep; or the dominance of wefts over warps which leads to markedly weft-face cloth, or tapestry. Reps are described in the section with warp-floats (pp. 529–535), and plain weave tapestries on pp. 518–529.

1. *Plain Weave, Striped Patterns*

One of the most obvious ways of creating simple patterns on plain weave cloth, especially if it is weft-face, is to insert picks of colored weft at any desired point while weaving. Horizontal bands of color will result, the pattern's effectiveness depending upon the weaver's skill in spacing bands, and in balancing them, both in terms of the colors used and of relative widths. This is the decorative technique so familiar to us in contemporary plain weave weft-face Pueblo and Navaho blankets and rugs. In spite of the simplicity of the concept only one weft-stripe plain weave has been recorded. Near the center of a white sash from Lake Canyon are eight narrow bands of brown weft picks. The shift from white to brown weft was accomplished by breaking off the white weft and knotting a length of brown thread to it (UM 29.43.181. Fig. 12. Appendix C, chart 22). The use of horizontal color bands is restricted almost entirely to *twill* weave fabrics (pp. 563–564).

Warp stripes are nearly as simple to produce as weft stripes, except that the weaver must plan his pattern in advance, grouping warps into color bands as he strings the loom. Colored warp stripes will obviously show more on a warp-face cloth. The fact that this type of plain weave is rare in the Southwest may account for the complete absence of warp stripes on wide fabrics. Vertical color bands are confined to the narrow rep belting described on pages 529–535 and to plaids and checks (pp. 492–496). In prehistoric Peru, where warp-face cloth was the rule, the use of vertical stripes was a very common decorative technique.



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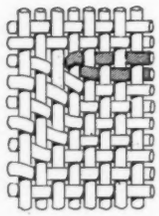

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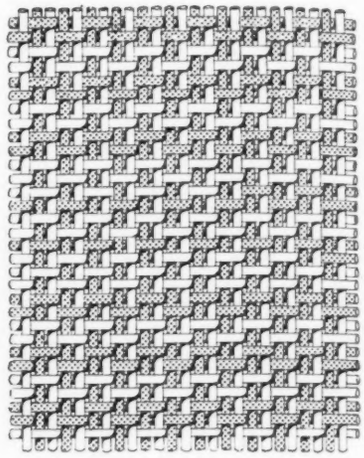

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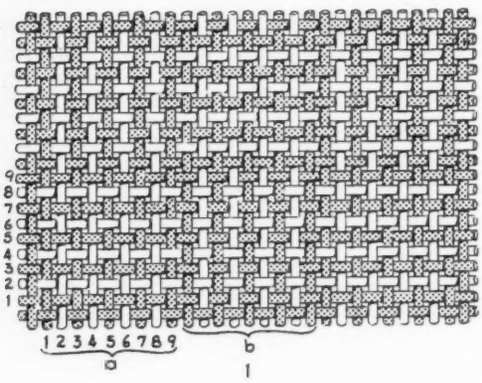

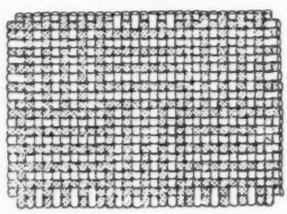

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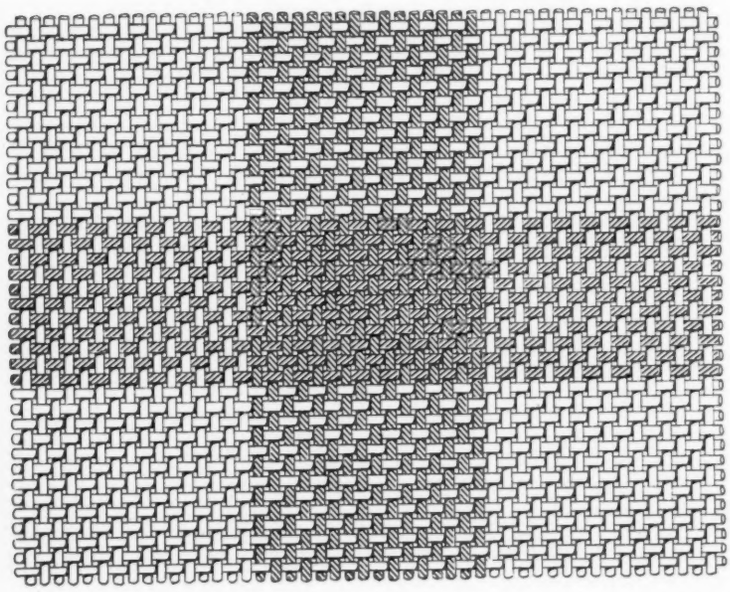

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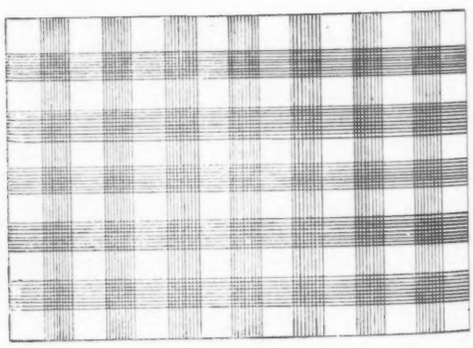

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D

FIG. 11.

2. *Plain Weave, Plaids, and Checks*

Technical Description

Plaid or check patterns are made by combining colored warp and weft stripes according to plan. In check patterns the stripes are of uniform widths, evenly spaced so as to make a design of squares like a checkerboard. Color bands in plaid patterns, on the other hand, vary widely in size and spacing.

Plain weaves with plaid or check designs are rare, numbering only six in all (Appendix C, chart 3, *a*). A seventh plaid cloth, from Los Guanacos, is woven in a fancy twill technique (pp. 549–550).

A simple brown and white check pattern was woven in the cloth (PM-A 5058) from the Pueblo I Tsegi burial mentioned above (p. 491). Sixteen brown warps alternating with 16 white produce the vertical color stripes. Horizontal brown and white stripes are 11 to 13 weft picks wide. White threads are slightly coarser than brown, so that there is a pleasing variation in surface texture as well as in color (fig. 11, D). The Canyon Creek fragment, probably a check or plaid, contains white and light brown (perhaps undyed natural brown cotton) warps.[9]

A less well-defined check pattern may be distinguished on a blanket from Ventana Cave (Burial #22). Warps are handled in pairs (p. 496), each of which usually contains one red and one white thread. Two red weft picks alternate with two white in the weave. The pattern is obscure because contrasting red and white units are small, and red threads are faded (fig. 11, B and 13). The alternate picking-in of two red and two white wefts probably required the use of two "bobbins," the weaver inserting two white wefts, then dropping the "bobbin" of white thread and inserting two red wefts. Weaving with multiple bobbins is a technical feature observed by O'Neale on the bast fiber cloths from northwestern Chihuahua.[10]

Two plaid fragments were found at Tonto Monument.[11] One is designed in white and blue-black color bands, the dark weft threads being two-ply (NPS—Lower Ruin—no number). The second (NPS–T 9/38) is a brown and white plaid (fig. 11, A). The brown threads, both warps and wefts, are two-ply. Brown warps have a slightly more reddish tone than wefts. This piece exhibits one weave technicality not observed on any other plain weave Pueblo cloth, ancient or modern. At one point, weft rows slant down towards the edge of the cloth, making the weave uneven. The fault has been corrected by drawing a weft only part way across the web, and then returning it to the selvage (fig. 11, A, 2). Ordinarily Pueblo weavers are careful to keep weft rows level by exerting equal pressure with the batten along each new pick. The practice of drawing a weft part way through the pick and then doubling it back to the selvage was used in weaving the Chihuahua plain weaves.[12]

From the Verde Salt Mine comes a cleverly designed red and white plaid (ASM 4031). By well-planned grouping of red and white threads the weaver has achieved in certain areas of this plain weave loom-woven cloth the effect of plaiting with broad, flat elements, such as is seen in some mats and baskets (figs. 11, C and 14). Here the pattern is built up of rectangular design units of two types, arranged like the

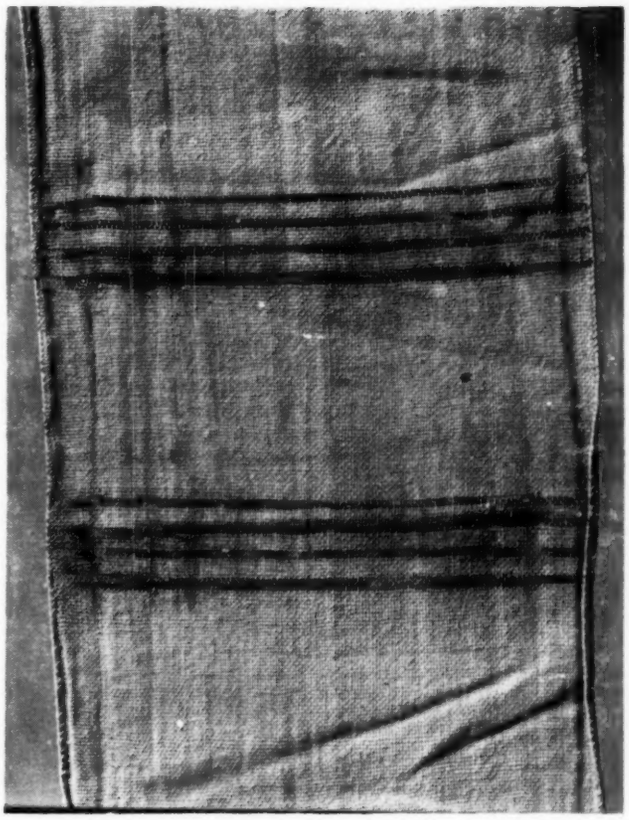


FIG. 12. Center section of plain weave sash, showing brown weft stripes. Width, 7½". Lake Canyon. (UM 29.43.181. Photo by Univ. Mus.)

[9] Haury, 1934: 91.
[10] O'Neale, 1948: 127–129.
[11] See also NPS-T 9/376, p. 496.
[12] O'Neale, 1948: 125–126.

FIG. 11.

A. Brown and white plaid from Tonto Monument (NPS–T 9/38). (1) Distribution of warp-weft stripes. (2) Correcting the downward slant of weft picks by drawing the weft only part way through the web.
B. Red and white check from Ventana Cave Burial #22. Half-basket weave with paired warps.
C. Red and white plaid from Verde Salt Mine (ASM 4031). (1) Distribution of colored warps and wefts: a. horizontally striped square; b. vertically striped square. (2) The effect of plaiting with broad, flat elements achieved by clever grouping of red and white threads.
D. Brown and white check from the Tsegi (PM–A 5058). (1) Grouping of colored warps and wefts. (2) Over-all check pattern.

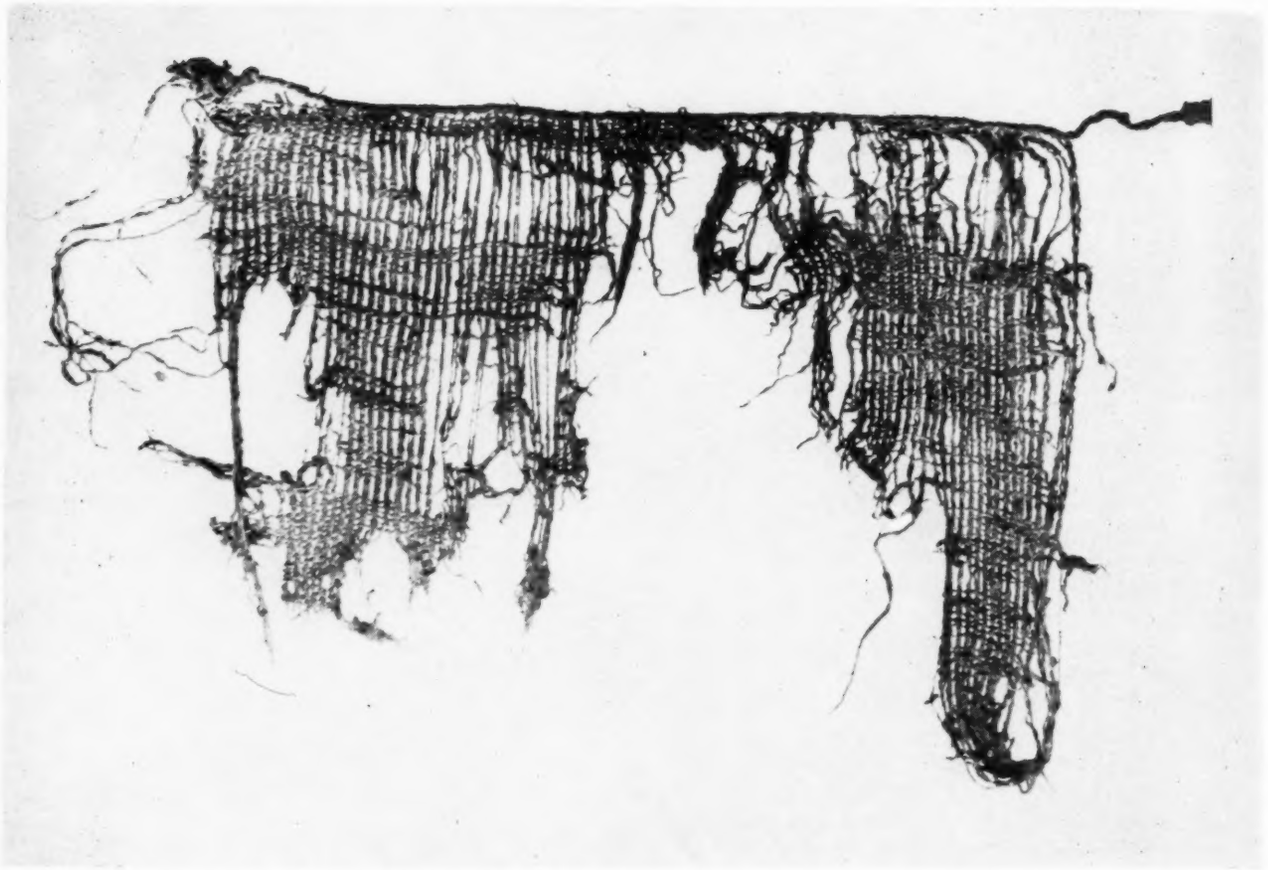


FIG. 13. Portion of red and white "check" cloth with paired warps. Ventana Cave, Burial #22. (Photo by E. B. Sayles.)

squares on a checkerboard. One type of square contains 9 alternating *horizontal* red and white lines one thread wide, and the second 9 alternating *vertical* lines one thread wide. Each square includes 9 warps strung in the following sequence: 1 red, 1 white, 1 red, 1 white, 1 red, 1 white, 1 red, 1 white, 1 red; and 9 wefts inserted in the same sequence. This means that every other warp is red except at the left and right edges of the squares, where there are two consecutive red warps, and alternate wefts are red except at upper and lower edges of the squares, where there are two consecutive red wefts. In horizontally striped squares, red wefts are carried over white warps and under red, and white wefts are carried under white warps and over red (fig. 11, C, 1, *a*). In vertically striped squares the rhythm is reversed so that red wefts are passed under white warps and over red, and white wefts are passed over white warps and under red (fig. 11, C, 1, *b*). A shift from the first to the second rhythm is brought about automatically with no change in the normal course of over-under plain weave, every nine warps by the stringing of two consecutive red warps, and every nine wefts by the insertion of two consecutive red weft picks.

The alternate picking-in of red and white wefts indicates use of two "bobbins" as for the Ventana Cave check.

The Uses of Plaid and Check Cloth

The three warp-weft stripe cloths identifiable to use were probably all blankets, worn during life and employed as grave wrappings after death. The Ventana check is from Burial #22, an infant of unknown sex.[13] The plaid cloth from the Verde Valley was wrapped about the head of a man who had been buried in the Salt Mine. The Tsegi and Canyon Creek fragments are from female burials.[14] At the present time plaid and check shoulder blankets are used by Hopi men and boys. I would have expected them to be associated with male burials prehistorically.

The Distribution and History of Plaids and Checks

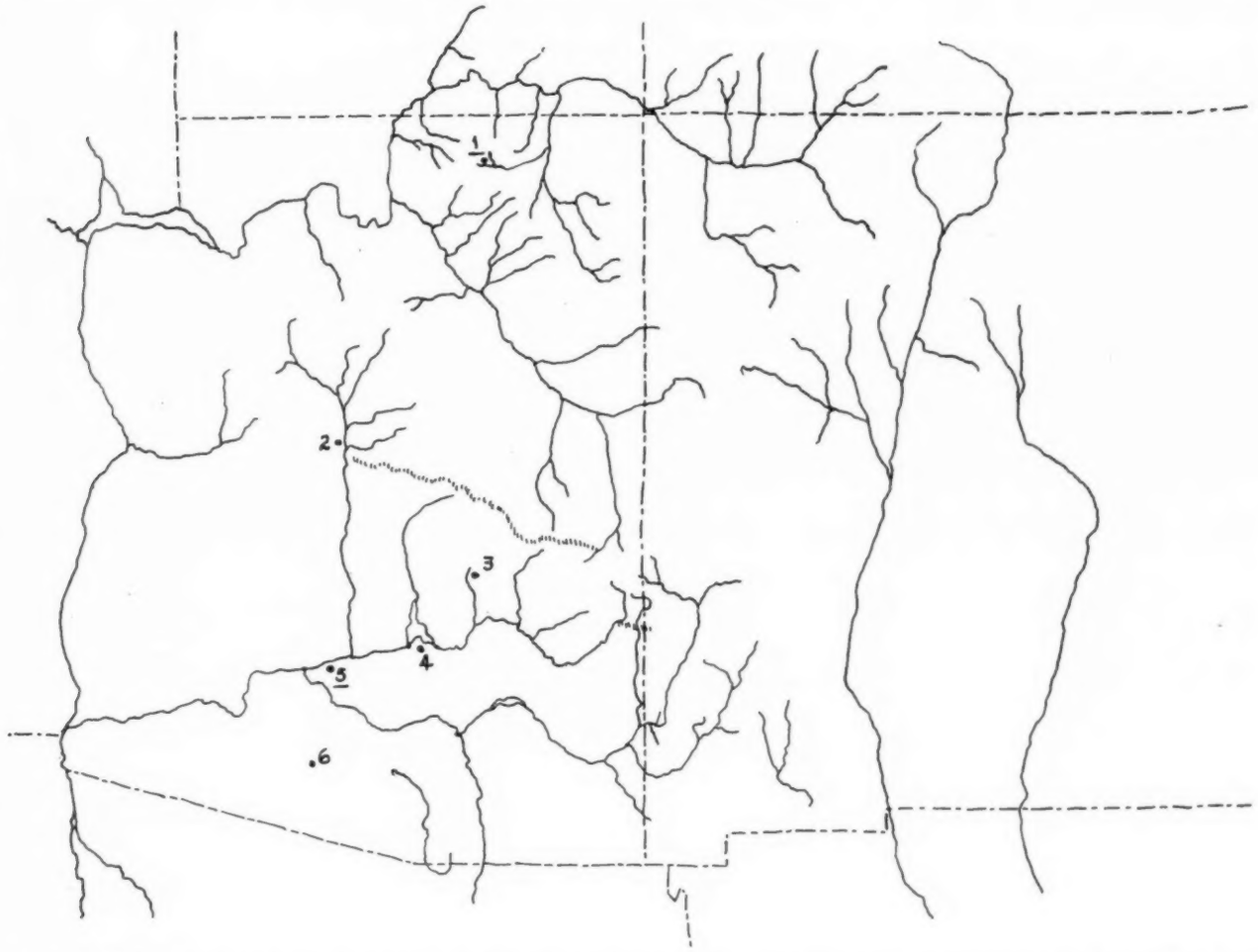
Plaid *designs* were undoubtedly common in the Southwest in pre-cotton horizons, worked into braids, mats, and baskets. Known examples include: the dog-hair braids from Obelisk Cave[15]; flat fiber braids and plaited mats from Canyon del Muerto[16]; and a brown and white plaid braid of an unidentified wool material

[13] Haury *et al.*, 1950: 466.

[14] Cummings, 1953: 124; Guernsey, 1931: 8–9; Haury, 1934: 91, 147.

[15] Amsden, 1949, pl. 3.

[16] AMNH 29.1/1806, 29.1/1807 and 29.1/1808 from Tseahatso; 29.1/3813, 29.1/4094 from Mummy Cave.



MAP 2. The distribution of plaids and checks. (Underlined sites date between 700 and 900. The remainder are Pueblo III–IV in period.) (1) Tsegi Canyon, Cave #1, Middle Branch, Grave 1, Burial 2. (2) Verde Valley Salt Mine. (3) Canyon Creek. (4) Tonto. (5) Los Guanacos. (6) Ventana Cave.

from Painted Cave (fig. 110). Some of the Chihuahua bast fiber plain weave cloths were also woven with plaid designs.[17]

Designing with warp and weft stripes is a simple concept and was probably carried over into loom weaving in cotton from the fiber cloths and as a direct copying of patterns on plaited textiles, mats, and baskets. It was apparently widespread in the Southwest in the earliest known cotton weaving horizons (700–900). One early piece comes from the Pueblo I Tsegi burial, and the plaid-patterned twill from Los Guanacos indicates that this type of cloth was also woven by the Hohokam at that time. Other examples, from Ventana Cave, Verde Salt Mine, Canyon Creek, and Tonto, are from more recent horizons (1000–1400). It is remarkable that the extensive Pueblo III Anasazi collections contain not one scrap of plaid or check cloth. The more so since tradition among the Hopi today dictates the use of brown and white or black and white check or plaid shoulder blankets for boys and men. The colors are those used in five of the seven prehistoric warp-weft stripe cloths. Modern Pueblo plaids are wool instead of cotton, color bands are two or three times as broad as those on prehistoric cloths and the weave is much coarser. Diamond twill is the customary technique, although some plain weave plaids and checks are woven.

Pueblo III Anasazi shoulder blankets were of unadorned plain weave, painted plain weave, "Anasazi twill" (pp. 563–565), or tie-dye. The absence of warp-weft stripe cloth seems to represent a break in weave tradition commenced in the north in 700 and important there historically. One can assume that such cloths were woven between 1100 and 1300 but chanced not to be preserved. My feeling is, however, that plaids and checks simply were not fashionable among the Anasazi at that time. Indeed, the Pueblo I Tsegi check may have been traded in from the south. This type of material may have been woven by both Mogollon-Pueblo and Hohokam from the inception of loom weav-

[17] O'Neale, 1948: fig. 22, *a*.

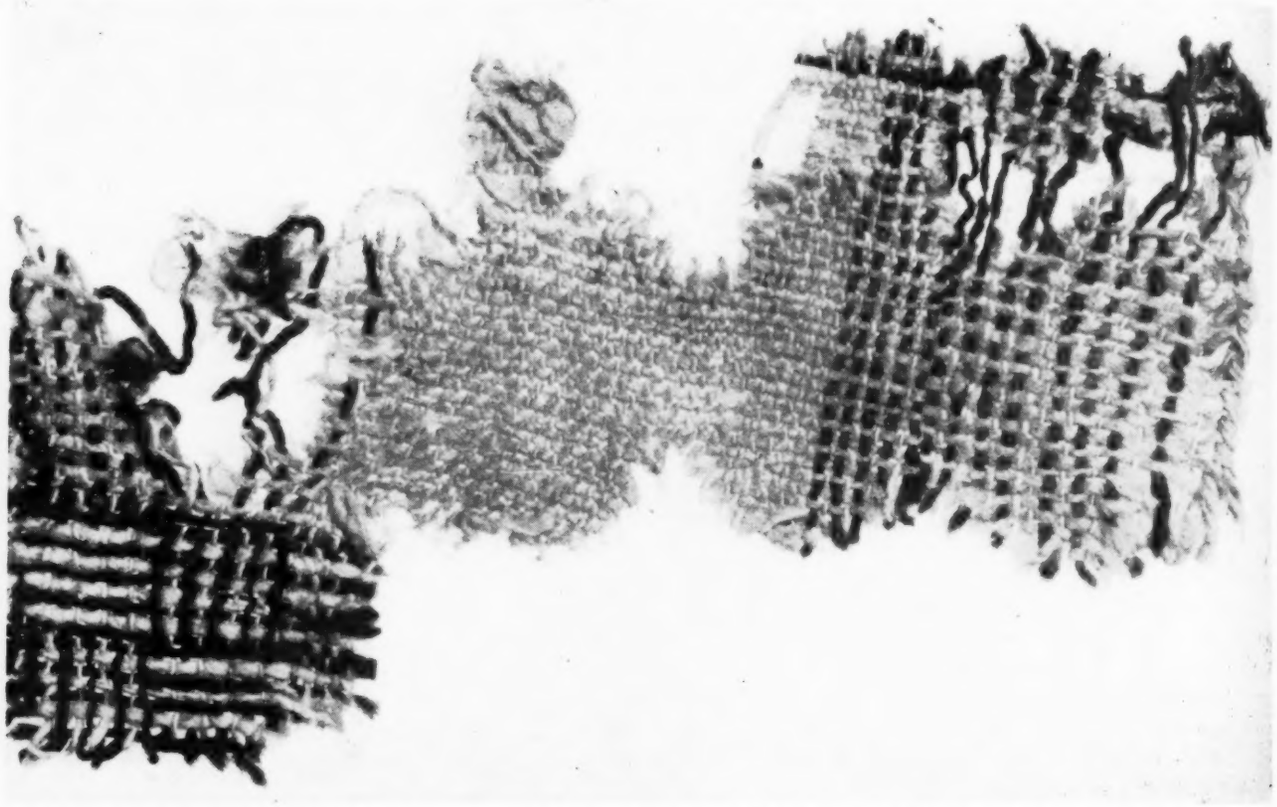


FIG. 14. Red and white plaid cloth fragment, width about 5". Verde Salt Mine. (ASM 4031. Photo by E. B. Sayles.)

ing until Pueblo IV, when it was introduced (or reintroduced) into northern Arizona to become a standard article of male apparel.

3. *Plain Weave, Paired Warps or Wefts*

Plain weave, by definition, requires the interlacing of single weft yarns with single warp yarns, one-over-one. If warps or wefts are paired the term must somehow be modified. O'Neale refers to a cloth in which both elements are paired as a "plain basket weave," and one in which warps are paired and wefts used singly as a "half- or semibasket weave." [18] The latter term may be extended to include those cloths in which wefts are paired and warps used singly.

Three examples of half-basket weaving in cotton have been recorded. In a small fragment, perhaps part of a plaid cloth, from Tonto Monument [19] the elements I would call wefts are single-ply black threads handled always in pairs, while the warps are single-ply brown threads used singly (fig. 10, C). Paired wefts are frequently seen in fiber and rag-weft cloths (pp. 497–500). The advantage of inserting wefts in this fashion is that the web grows to completion more rapidly.

The second half-basket plain weave is the red and white checked blanket from Ventana Cave described above (p. 493), wherein warps are grouped in pairs. In this case heddle loops must enclose warps 1,2–5,6–9,10–etc., while the shed rod passes behind the alternate pairs, or 3,4–7,8–11,12–etc. (fig. 10, B). Heddle and shed rod are then handled exactly as in simple plain weaving with single warps. According to O'Neale this type of half-basket weave is characteristic of cotton cloths of present-day Highland Guatemala. She relates the practice of grouping warp yarns to the type of thread used there. This is a fine, single-ply cotton which can better withstand the strains of tension and friction to which warps are subjected on the loom if used in pairs, threes, or fours.[20] The third half-basket weave is a warp-face band from Gourd Cave described on pages 530–531.

No basket or half-basket weave cloths are woven by contemporary Pueblo Indians.

4. *Plain Weave with Heavy String Used for Decorative Wefts*

Three small plain weave fragments are decorated by the insertion of heavy cotton string in place of certain regular single-ply wefts. In all cases both string and cloth are natural white cotton, the strings making

[18] O'Neale, 1945: 56 and fig. 23, *a–i*.
[19] NPS–T 9/376. See Appendix C, chart 3, *b*.
[20] O'Neale, 1945: 56.

effective patterns of raised horizontal bands on the surface of the cloths.[21]

One fragment (ASM 5408, provenience unknown) shows the substitution of three-ply string for regular weft every other pick for eight rows (fig. 10, I). A second piece, from White House (AMNH 29.1/7897a), contains five-ply wefts grouped into bands which are separated by an inch of regular plain weave. Each band includes four heavy wefts spaced three single-ply wefts apart. The complete width of the cloth is five and a half inches. It may be part of a sash or a breech cloth end. The weave and selvage detail are shown in figure 10, J 1 and 2.

A complete rectangular fabric (PM 33–62–10/2005) measuring 8½ by 10½ inches from Floating House Ruin is decorated with three horizontal bands, each consisting of six picks of soft, thick (⅛ inch) weft alternated with single-ply wefts. The bands are spaced slightly more than an inch apart (fig. 10, G 1 and 2). Thick weftage, in this case, is composed of two three-ply threads S-twisted together. The piece is Pueblo I or II in date. The use of this and other rectangular cloths as aprons is suggested in pages 617–618.

Also from Floating House comes a tiny fragment (PM 33–62–10/2720) of silk-like cloth woven from exceptionally fine S-spun single-ply apocynum fiber thread.[22] A warp-face cloth, the thread count is ninety-eight warps and thirty-four wefts to the inch. There are three weft picks composed of six-ply threads woven in at one point to form a raised band on the plain weave surface. The piece appears to be loom-woven, after the manner of the cotton cloths just described. It is an example of skillful spinning and fine weaving not equalled in any other Southwestern textile on record (fig. 15, B). The only cotton fragment approaching it in delicacy is the "eccentric plain weave" described below.

The insertion of heavy wefts is not practiced currently in the Southwest. No mention of it is made in the literature on prehistoric Peruvian weaving. A somewhat similar technique, in which, however, the heavy weft is generally pulled into pile loops, is widely used in Mexico today, but thought to be a Spanish introduction.[23]

5. *Eccentric Plain Weave*

The term "eccentric plain weave" has been chosen to describe a small fragment (NPS–T 9/28) from Tonto, in which the treatment of warp and weft varies considerably as weaving proceeds (figs. 10, H and 15, A). Warps are handled sometimes as pairs, sometimes singly. Wefts are two-ply threads, or two-ply threads twined together to make four-ply units. Weft threads may be beaten closely together to obscure completely warps, or spaced as in regular plain weave.

"Plain weave" is a term referring to cloth in which warps are controlled by one heddle and one shed rod. Mechanical construction of the Tonto piece would require two heddles to control alternate pairs of warps and one heddle and a shed rod to control alternate warps when used singly. Hence the term "eccentric *plain weave*" is not entirely apt. However, we have seen that cloth in which warps are used in pairs may be structurally plain weave, as well as cloth in which warps are used singly, and that plain weaves may have varied weftage.

Approximately 1⅝ inch square, the fragment in question surpasses in delicacy and finesse any Southwestern cotton fabric on record, not excepting the structurally more complex weft-wrap openwork weaves. Warps and wefts are extremely fine two-ply threads, the warps numbering fifty-five to the inch. There is one edge over which warps loop. Starting here the following weft rows were inserted, in the order given, within the space of about one-fourth of an inch:

—One row twined doubled weft threads.
—Four rows plain weave in which single wefts cross alternate pairs of warps, and are beaten closely together to hide the warps as in tapestry weave.
—One row twined doubled weft threads.
—Five rows plain weave wherein single warps are crossed by single wefts, and the wefts are not closely battened.

This rhythm is repeated four times to a frayed edge. In those sections where warps are separated and crossed one at a time, rather than being crowded together in pairs, a creped effect results. So far as I know, this piece is unique.

6. *Plain Weave, Rag-Weft*

Technical Description

Rag-weft cloths are coarse plain weaves in which weftage consists entirely or in part of rolled strips of cotton cloth or bundles of cotton threads (figs. 10, D, E, F, 16 and 17). Resembling rag rugs in appearance, the cloths may contain cotton alone, or cotton in combination with fiber thread. They were constructed on the loom after the manner of ordinary plain weaves. Remaining selvages are identical to those on loom-woven cottons. Warp counts range from six to fourteen threads to the inch.

The collections include twenty-six examples of rag-weft.[24] In addition to these there are two references by Fewkes to cotton and agave fiber cloth, which might be interpreted to mean rag-weft.[25] Sixteen fragments

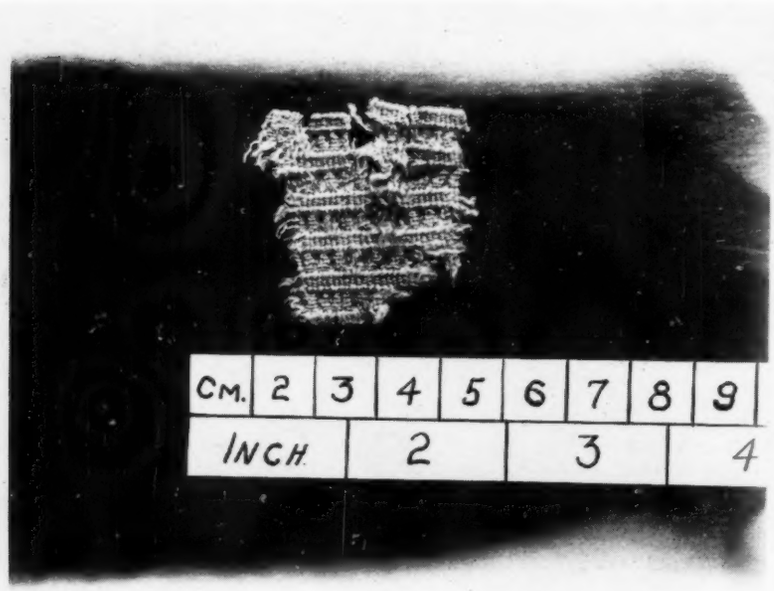
[21] See Appendix C, chart 3, *c*. See also the weft-float pattern weave from White House, pp. 558–559.

[22] The identification was made by Miss Marcelotte Leake at the Peabody Museum, July, 1946.

[23] Kelly and Palerm, 1952: 227.

[24] See Appendix C, chart 3, *d*.

[25] Fewkes, 1896: 272 refers to "cotton and agave" cloth from Honanki; and in 1912: 147, to "agave fiber . . . used in combination with cotton" at Casa Grande. See also Hough, 1914: 81–82.



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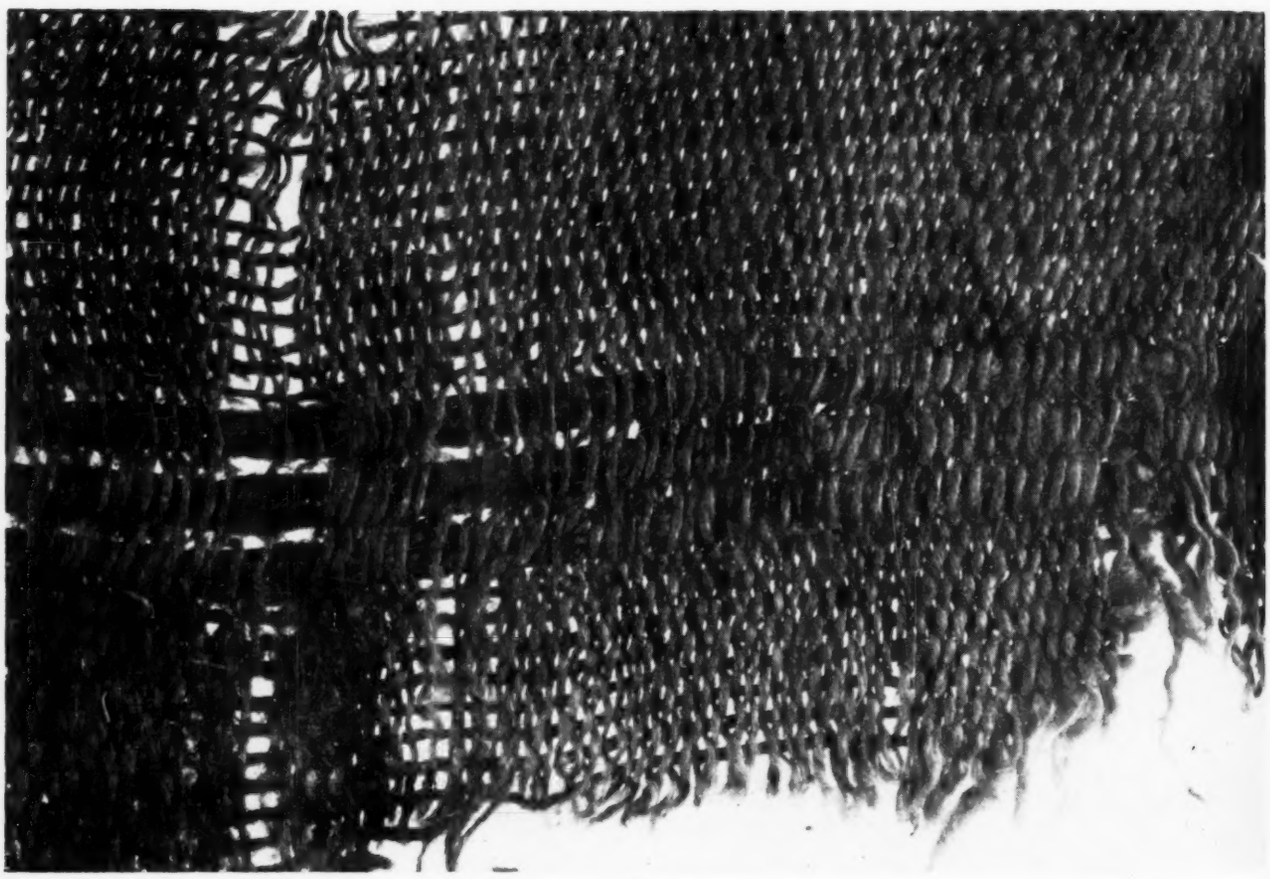

B

FIG. 15. A. "Eccentric" plain weave, about 1⅝" square. Tonto Monument. (NPS–T 9/28. Photo by National Park Service.) B. Plain weave apocynum cloth with heavy string wefts. About 5 times natural size. Floating House Ruin. (PM 33–62–10/2720. Photo by Peabody Museum.)

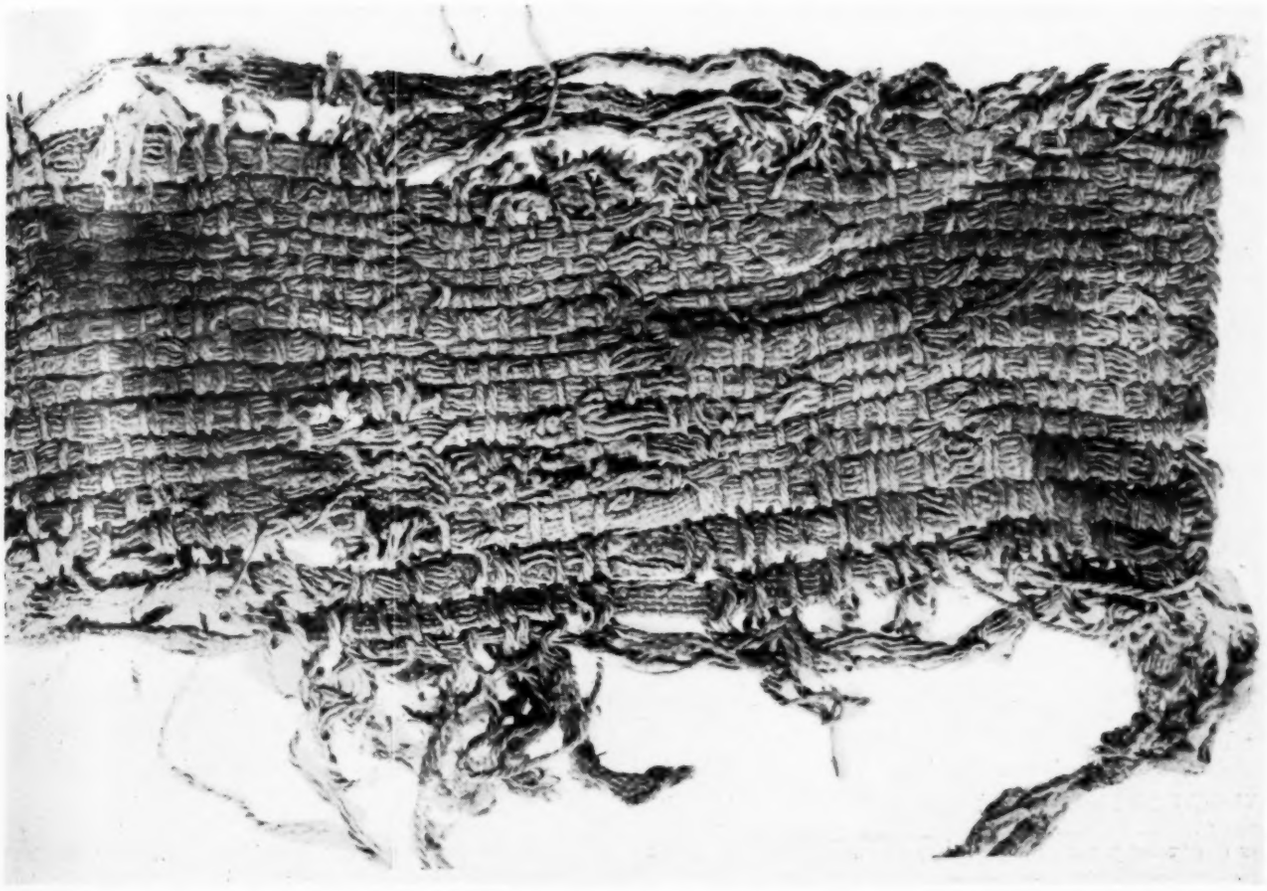

FIG. 16. All-cotton rag-weft cloth, reduced slightly. Tonto Monument. (ASM 14559. Photo by E. B. Sayles.)

are woven entirely of cotton. Warps of these are one-, two-, or five-ply threads, wefts are either rag strips or rag strips together with regular single-ply thread. One piece contains fiber warps and rag wefts,[26] and another[27] two-ply cotton warps interwoven with rag strips and single-ply fiber wefts. Seven specimens combine fiber warps with rag strip and fiber thread weftage. In four of these fiber wefts are paired (fig. 10, D). Concerning the make-up of one piece (USNM 254860), I have no information.

Rag strips were torn from plain weave cotton cloth, usually un-dyed. Originally from a half to three-quarters of an inch wide, the strips were folded or rolled to a width of one-fourth inch or less before being woven in. Rag-wefting was undoubtedly one means of utilizing badly worn cotton cloth, too far gone for further mending or patching. We follow the same practice in making rag rugs. Judging from the large amounts of worn, darned, and patched cloth in the collections, a high premium was put on cotton fabrics, and they were preserved for use as long as possible. This attitude seems natural enough if one considers the difficulties involved in producing a cotton garment—from planting, cultivating, and harvesting the plant, through the laborious and time-consuming processes of hand-spinning and weaving. It is no wonder that even the tiny scraps of worn-out clothing were re-utilized in rag-weft fabrics.

Except in the case of rag-wefts from Montezuma Castle and Canyon Creek, bast fibers have not been subjected to botanical analysis. Two varieties of yucca were used at Montezuma Castle, and Haury reports that the Canyon Creek rag-wefts contained apocynum thread.[28]

The Uses of Rag-Weft Cloth

Only one complete rag-weft cloth, probably a sandal insole (NPS–T R–3. p. 618), has been found, so the uses made of these coarse fabrics remains a matter for guesswork. One all-cotton fragment from Tonto Monument (NPS–T 9/33) has a corner braid resembling those on plain weave blankets. Somewhat heavier than regular cotton cloth, rag-weft may have been valued for warmth and woven in the form of blankets

[26] Haury, 1934: 102.
[27] NPS–T 9/714.

[28] Montezuma Castle analyses were made by A. C. Whitford. For Canyon Creek see Haury, 1934: 101–102.

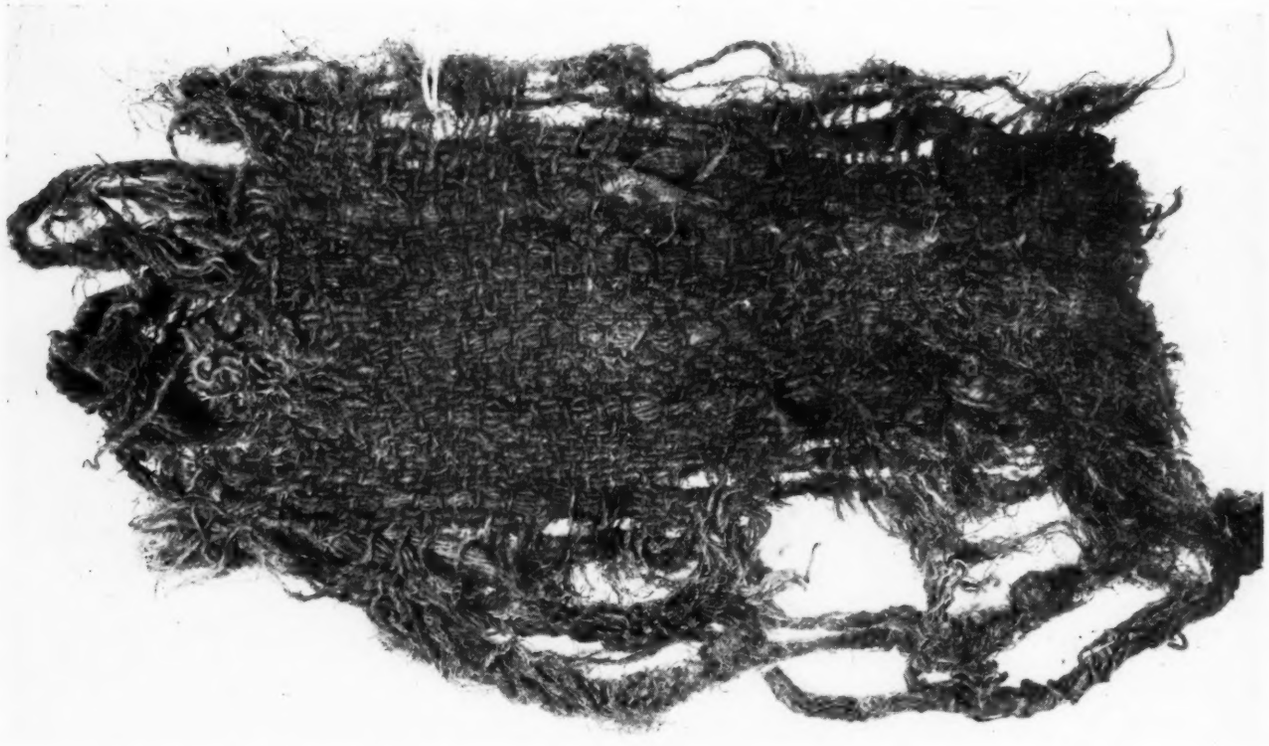

FIG. 17. Yucca fiber cloth. Plain weave with paired wefts and cotton rag strip wefts. Montezuma Castle. (NPS–MC 11. Photo by Denver Art Museum.)

for everyday wear and sleeping in cool weather. Such blankets probably also served as burial wrappings.

The Distribution and History of Rag-wefts

All rag-wefts of known provenience come from late Pueblo III and IV villages south of the Mogollon Rim.[29] Fragments were plentiful at Tonto National Monument, Montezuma Castle, Honanki, Palatki, Canyon Creek, and the Verde Valley. This type of cloth, while not rare, is strikingly limited in distribution to Southern Sinagua and Salado sites. It may have been a local invention by one of these groups for salvaging worn cotton. The only use established for cotton rag strips in the north is as sandal wefts and ties at Gourd Cave and Betatakin (p. 618).

The utilization of bast fiber in post-Basketmaker loom weaving was apparently more prevalent in the south than among the Anasazi. Plain weave fiber cloth resembling coarse burlap was found in Ventana Cave, Honanki, Palatki, Montezuma Castle, Canyon Creek, Tularosa Cave, and Bear Creek Cave.[30] Haury reports that at Canyon Creek, in contrast to northern cliff dwellings: ". . . Apocynum fiber was used equally as much as cotton in the weaving of textiles," a fact which he thinks may result from Hohokam contacts and from the difficulty of growing cotton in that area.[31] It is possible that weaving with bast fibers was carried over among the Mogollon of east central Arizona and southwestern New Mexico from pre-cotton horizons into the early Pueblo periods as a result of the fact that not enough cotton was raised locally to meet the needs of the people. Plain weave and plain weave rag-weft cloths continued to be woven in Pueblo IV times in accordance with this early practice, even in the Upper Verde and the Tonto Basin where cotton was presumably plentiful. The only reported Anasazi-Pueblo loom-woven basts come from Floating House (Pueblo II) and Pueblo Bonito (Pueblo II or early III).[32] Such material is not characteristic of Anasazi Pueblo III weaving.

Early Spanish accounts of clothing at the Zuni Pueblos mention blankets of fiber thread, whereas descriptions of textiles in the other Pueblo villages speak only of cotton.[33] Possibly the presence of bast cloth at Zuni indicates the survival there of an early Mogollon-Pueblo tradition.

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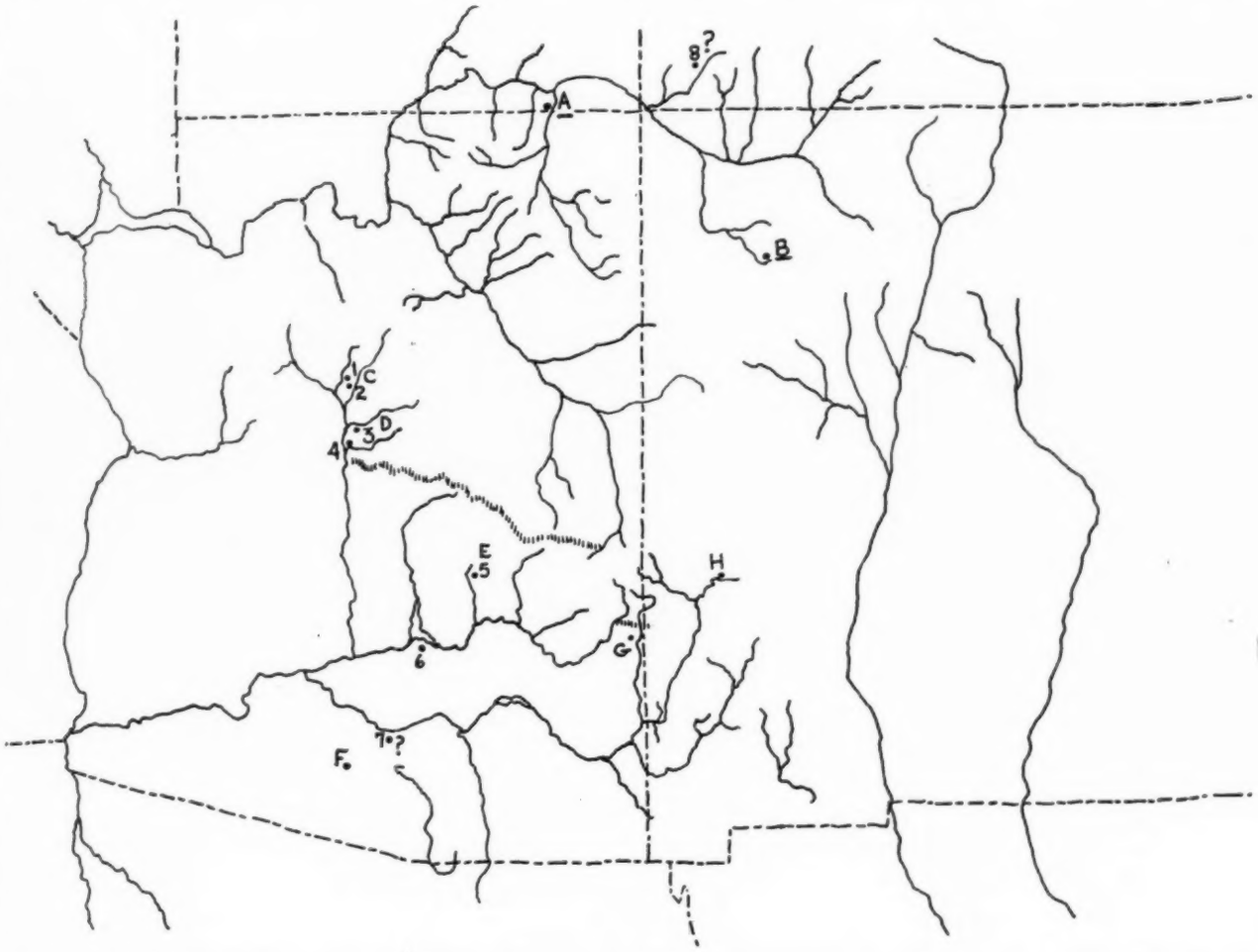
[29] There are two pieces from unknown sites: USNM 254860, doubtfully assigned to Mesa Verde; ASM 9329, no record of provenience.

[30] See Appendix A, p. 658.

[31] Haury, 1934: 87, 154.

[32] For a description of the Floating House bast cloth, see p. 497. Yucca cloth was reported used as a burial robe in Room 32, Pueblo Bonito. Pepper, 1920: 138.

[33] Bolton, 1916: 185, 235, 268; Winship, 1896: 569.



MAP 3. The distribution of rag-weft and loom-woven bast fiber cloths, Pueblo III–IV. (Numbers mark the sites containing rag-weft cloth, letters those from which loom-woven bast has come. Question marks indicate sites for which information is doubtful. *A* and *B* are underlined as they are Pueblo II or early III in date, and not typical of Anasazi Pueblo III textiles.) (1) Honanki. (2) Palatki. (3) Montezuma Castle. (4) Verde Valley. (5) Canyon Creek. (6) Tonto. (7) Casa Grande. (8) Mesa Verde. (A) Floating House. (B) Pueblo Bonito. (C) Honanki and Palatki. (D) Montezuma Castle. (E) Canyon Creek. (F) Ventana Cave. (G) Bear Creek Cave. (H) Tularosa Cave.

OPENWORK WEAVES

Introduction

There are two loom weaves, weft-wrap openwork and gauze, which are designed to produce fabrics having somewhat the appearance of lace. Each of these techniques is described separately below, but the two are considered together in discussions of history, distribution, and use, since they tend to appear in combination on a single cloth. Forty-seven pieces of weft-wrap openwork and gauze have been studied, thirty-eight consisting of weft-wrap alone, five of weft-wrap and gauze combined, and four of gauze alone (see Appendix C, chart 4).

1. *Weft-Wrap Openwork*

Definition

Weft-wrap is a technique for producing openwork designs on a plain weave cloth. As weaving proceeds, a selected weft is inserted but not carried the full width of the pick. Instead, it is wrapped tightly about certain warps and previously inserted wefts so as to draw them apart, forming a small hole. Design elements are built up by grouping these holes according to a preconceived plan.

Technical Description

There are several variations of the weft-wrap technique. The simplest form appears on a fragment from Bear Creek Cave, illustrated in figure 18, B.[34] Here

[34] USNM 246123. Hough, 1914: 77, fig. 160. Two fragments (*a* and *b*) by this number were found by me in the United States National Museum collections. Other pieces described by Hough, pp. 77–79, could not be located. My analysis differs from Hough's in that he figures both warp and weft as wrappers, while I found the two fragments listed to be regular weft-wrap. In my opinion the other pieces he describes were probably weft-wrap also.

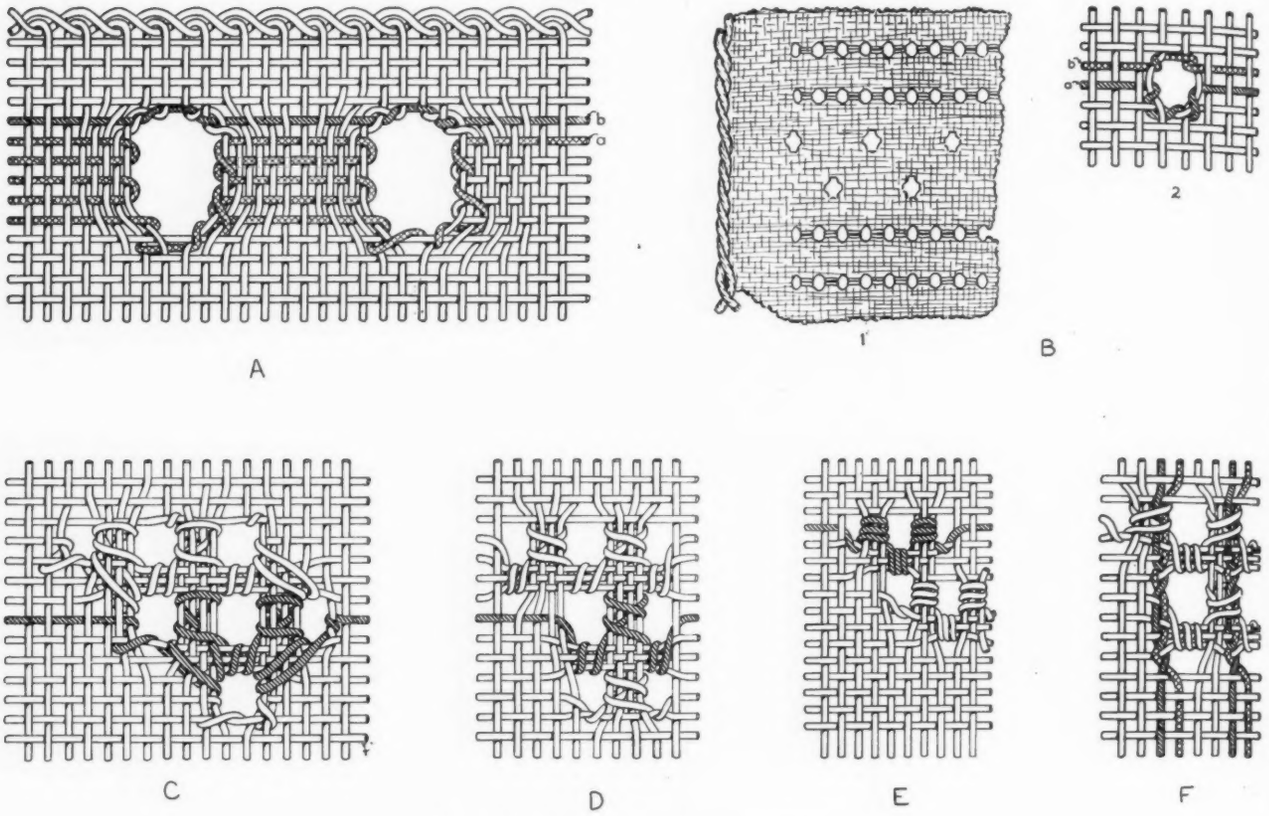


FIG. 18. Weft-wrap openwork techniques.

A. Snaketown fragment. (Gladwin *et al.*, 1937: 161, fig. 62.)
B. Design (1) and method of making decorative holes (2) on a cloth from Bear Creek Cave. (USNM 246123. Hough, 1914: 77, fig. 160.)
C. Oblique and parallel wrapping. Montezuma Castle. (NPS–MC 34.)
D. Parallel wrapping. Tonto. (NPS–T 9/421.)
E. Parallel wrapping. White House. (AMNH 29.1/7990B.)
F. Weft-wrap with warps crossed to define holes. Doolittle Cave. (PM 95483. Cosgrove, 1947: 78, fig. 31, *a*.)

isolated holes, spaced several warps and wefts apart, were produced in the cloth. This was done by drawing the weft (*a*) from right to left through the warps to the point where a hole was to be made. There it was wrapped about the warp last crossed, down and twice around the weft below, and around the next warp to the left. By pulling the weft thread tight the two warps in question were stretched apart and a hole formed in the cloth. The weft was passed to the left in normal plain weave until another hole was to be made, when the process was repeated. As it was returned through the next pick, from left selvage towards right selvage, the same weft (*b*) was wrapped again about the two warps in question, further defining the hole. The openings are slightly less than an eighth of an inch in diameter.

A somewhat more complex method of making decorative holes may be seen on a charred fragment from Snaketown.[35] Holes are about twice the diameter of those on the Bear Creek cloth (fig. 18, A). A description of the probable technique of manufacture reads, in part (p. 161, *op. cit.*):

> After the required amount of plain weave was completed weaving was continued back and forth from the selvage to the right side of the right-hand opening, for four wefts, each weft being pulled very tightly. The next entry of the weft, A, crosses the fabric to the right side of the open space, where it turns downward, and crosses the lower edge of the opening by a tightly pulled wrap technique. A is then woven into the solid area between the completed opening and the next one to the left, by the method just described. The process continues across the cloth, until the series of open spaces is finished, and the left selvage reached.
>
> The next entry of the weft, A′, is from left to right. It closes the openings and brings the warps into their normal positions. This is done by a simple over and under weave. However, the pairs of warps immediately bordering the top edges of the open spaces, are crossed and twisted together in such a way that, held in place by the weft, they round off the top of the opening and straighten the warps.

(In our drawing the weft pick passing from right to left is marked *a*, and that passing from left to right, *b*.)

The Bear Creek and Snaketown fragments are the

[35] Gladwin *et al.*, 1937: 161–162.

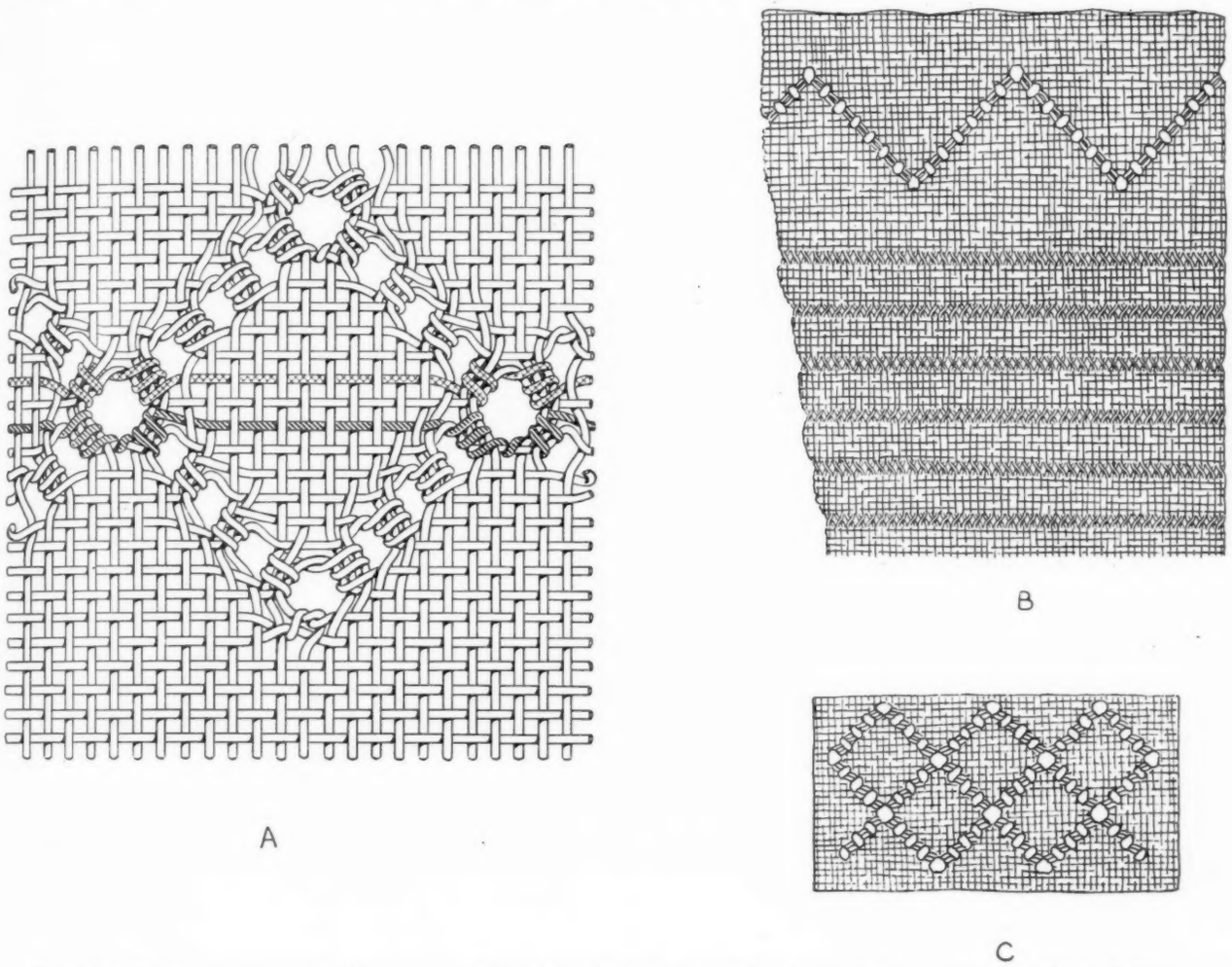


FIG. 19. Weft-wrap openwork with every second weft used as a "wrapper," and two cloths patterned by this technique.
A. Detail of the wrapping technique on a fragment from Tonto. (NPS–T 9/645.)
B. Border of openwork on a gauze weave cloth from Tonto. (NPS–T 9/591.)
C. Fragment from Tonto. (NPS–T 9/645.)

only weft-wrap fabrics decorated with rows of holes spaced well apart. The more usual procedure was to arrange the small openings consecutively into lines of varying lengths, which, placed one above the other, formed a design element. Easily the most common technique was that in which every fourth weft served as a "wrapper." There are variations in minute details of its manipulation (fig. 18, C–F), but the principle remains unchanged. The wrapper may run parallel to the line of warp or weft, or on the oblique between the two.

In a typical weft-wrap of this nature, plain weaving proceeded until a row of holes was desired. The weft was then drawn through its shed to the point where a hole was to be started. Here it was carried down and around the three wefts immediately below it. These three wefts were drawn tightly together, and the wrapper returned to its normal plane, woven through the next four warps, and then wrapped tightly about them. These two steps could be repeated indefinitely. When the desired number of holes had been produced in this fashion the weft was passed on through the pick to the selvage. The next three weft picks were in plain weave. The wrapping process was repeated in the fourth weft pick. The weaver had the total pattern he wished to make clearly in mind so that he knew where to place each line of holes, and how long each should be. Some of the complex designs worked in weft-wrap of this type are illustrated in figures 22, 23, and 24.

Less frequently noted in the series is the technique of using every second weft as a wrapper, rather than every fourth. The process is illustrated in figure 19, A. Examples come from Ventana Cave, Tonto Monument, and Mule Creek Cave.[36] This technique was used in making oblique lines one or two holes wide, rather than

[36] ASM, Ventana Cave Burials #9 and #22; Haury, 1934: 97 and pl. LX, Tonto; NPS–T 9/591 and 9/645, Tonto; PM 34–12–10/2738, Mule Creek Cave.

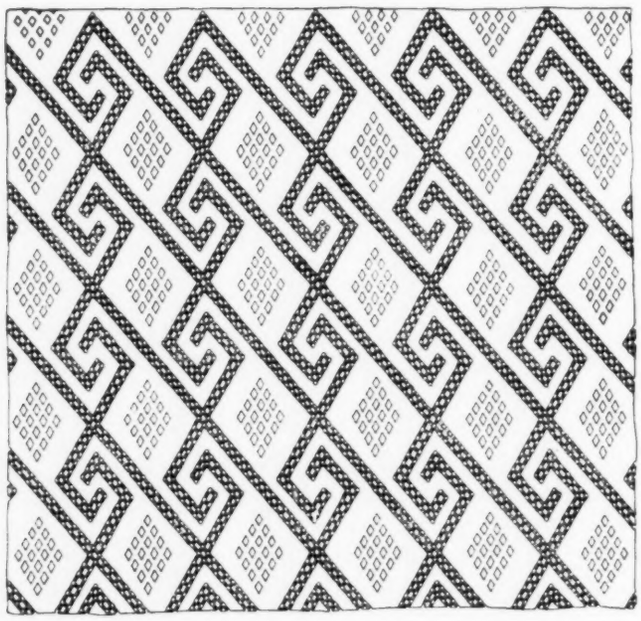


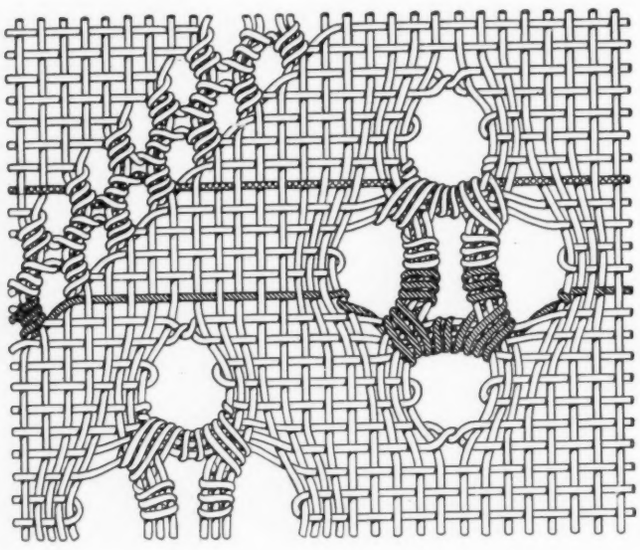
FIG. 20. Design in weft-wrap openwork on a cloth from Mule Creek Cave. (PM 34–12–10/2738. Cosgrove, 1947: fig. 86, *a*, *b* and *d*.)

larger design units such as triangles or diamonds (figs. 19, B and C; 20; and 21).

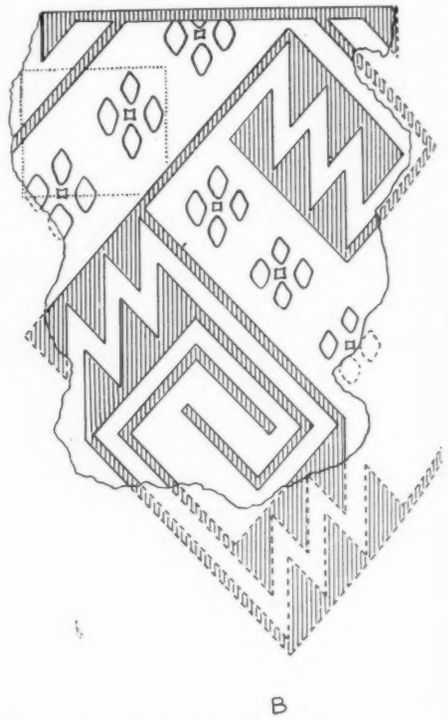
The most elaborate weft-wrapping studied is that on two fragments—parts of one cloth, originally—from Ventana Cave.[37] Reconstructed from extremely fragile and limited material, the technique and resultant design (fig. 21) are nevertheless believed to be essentially correct. It will be seen that wefts do not always run the full width of the cloth, but are woven back and forth over limited numbers of warps in accordance with the demands of the design, a feature noted also for the less elaborate Snaketown specimen.

Cloths decorated with weft-wrap patterns tend to be finely woven, with thread counts running slightly to noticeably greater than the average for plain weave. All but two are of white cotton. These two, both from Tonto Monument, are dyed brown.[38]

The effect produced by weft-wrap simulates Old World drawnwork (Italian *buratto*, or Spanish *deshilado*), which is done *after* the plain weave cloth is removed from the loom, by drawing out certain warp or weft picks, then filling the spaces with threads woven in with a needle. These threads draw certain warps or wefts together to produce openwork patterns. The familiar hem-stitching is a good example of the process. The resemblance, however, is a superficial one. There can be no doubt that openwork on prehistoric Pueblo fabrics was done during the weaving process with the cloth on the loom. Where side selvages remain it can be seen that weft picks are one continuous yarn, turning back into the web after passing around the edge warp or



A



B

FIG. 21. Weft-wrap openwork on a fragment from Ventana Cave, Burial #9. The area enclosed by the dotted rectangle in B is enlarged in A to show the wrapping techniques.

[37] ASM, Ventana Cave Burial #9. See also Haury *et al.*, 1950: 454–455, figs. 106–107.
[38] NPS–T 9/517 and 9/544.

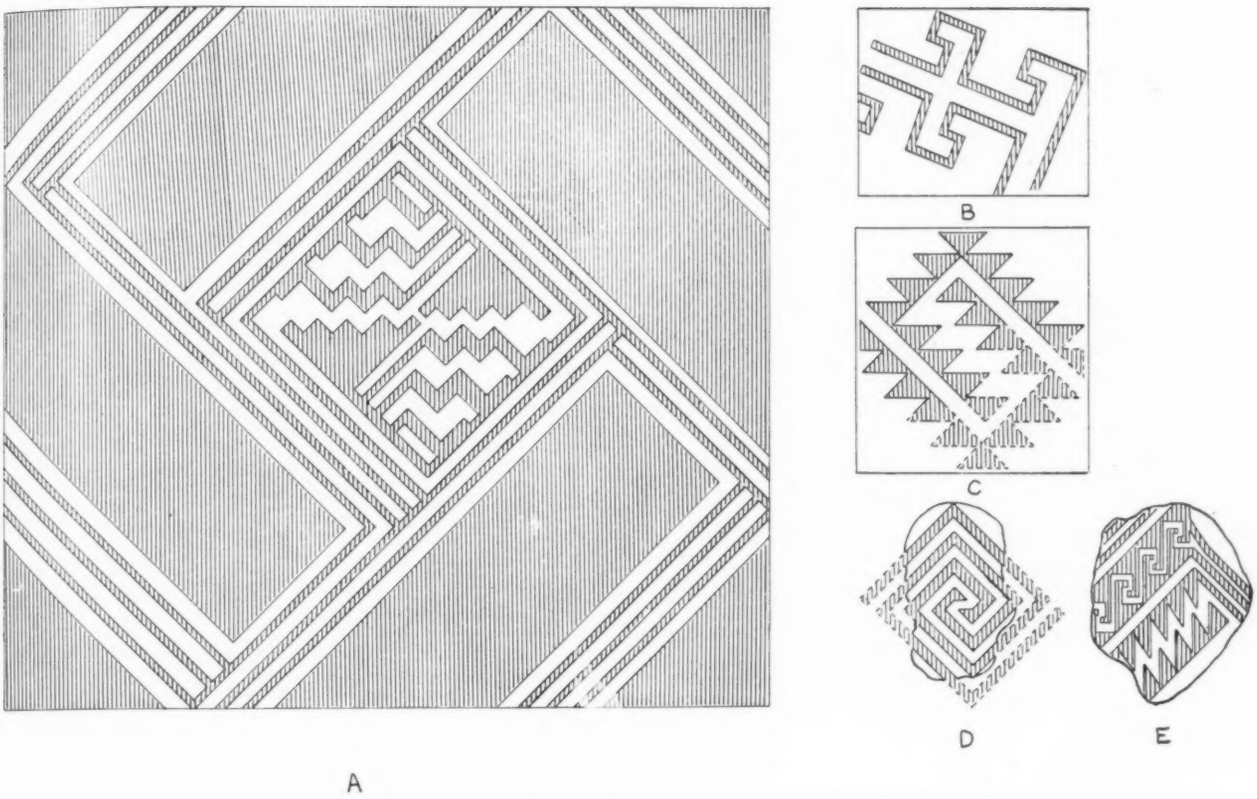


FIG. 22. Weft-wrap openwork designs. (Openwork portions are indicated by shading.)

A. Pattern on a complete cloth, 15⅜" by 12½" in size. Nitsie Canyon. (ASM 2151.)
B. Design on a fragment from Montezuma Castle. (NPS–MC 34.)
C. A unit pattern on a bag from Canyon Creek. (Haury, 1934: 93, fig. 19.)
D, E. Designs on small pieces of cloth thought to have come from Canyon de Chelly. (Private Collection.)

between selvage threads. If certain wefts had been pulled out, then re-inserted, the yarn would have been cut at one edge of the cloth. Once understood, weft-wrap openwork becomes in fact a simple technical device for producing a design. In laboratory tests the process was greatly facilitated by the use of a needle. It is highly probable that prehistoric weavers used needles (p. 489 and fig. 8, B) in making their delicate fabrics. If so, weft-wrap may be thought of as a kind of embroidery done on the loom.

Designs on weft-wrap cloths fall into five categories:

(*a*) Narrow zigzag lines (fig. 19, B).

(*b*) Parallel rows of holes spaced several warp and weft picks apart (fig. 18, A and B).

(*c*) Patterns built by arranging elements along lines which are oblique to the right angle formed by warp and weft. These patterns are so constructed that they have no logical margins, and could be carried to infinity. They seem to represent a part of a larger design held in the weaver's mind. These patterns, both as to elements and the way in which elements are combined, are typical of those found on Pueblo III and IV cotton fabrics of many techniques. Weft-wrap designs of this type might cover the entire surface of a cloth, or might be oriented in border areas at top and bottom warp selvages of plain weave cloths (figs. 20 and 23).

(*d*) Patterns built on oblique lines, as Type (*c*), but conforming to the design area. The weaver has taken into consideration the projected size of his cloth and conceived his pattern to fit as a unit within this area. This type of designing is less frequently seen on prehistoric textiles as a whole than is Type (*c*) (figs. 22, A and 24, E).

(*e*) Unit designs. A unit design is a small figure, three to five inches high, and complete within itself. Its component parts, or elements, are no different from those commonly used in prehistoric Pueblo textile designing. However, the combining of elements into small independent figures, isolated from one another by areas of undecorated weave, is infrequently represented in techniques other than weft-wrap. Unit designs were sometimes oriented along the borders of plain weave cloths. In the case of the child's poncho from Ventana Cave, such a figure falls on the wearer's chest (figs. 24, C, 25, and 26). Further discussion of textile design will be found in Chapter VII.)

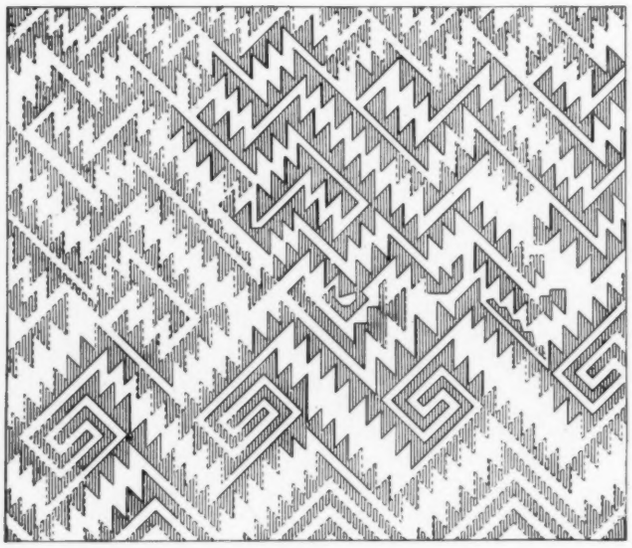


FIG. 23. Design on a weft-wrap cloth fragment (17½" by 17⅝" in size) from Ventana Cave, Burial #34. Reconstructed portions of the design are drawn with dashed lines.

2. *Gauze Weave*

Definition

Gauze is a lace-like fabric in which horizontal rows of openings have been made in plain weave cloth by twisting two adjoining warps a half-turn about each other and holding them thus with the insertion of a weft pick. One or more openwork rows alternate with plain weave sections.

Technical Description

As stated in the introduction to this section, our knowledge of gauze weave is based on the study of nine examples.[39] Gauze is the only true loom technique in which warps move to right or left of the position in which they were originally strung. Ordinarily warps are rigidly confined in their sideways movements.

Two methods of crossing warps so as to produce a line of openwork are illustrated in figure 28, C. In one the loom is rigged as for plain weave (fig. 28, C, 2). The first step is taken with the warp set controlled by the shed rod in forward position. The first of these forward warps at the right edge of the web is forced to the left over and then behind the first warp of the heddle-controlled set, and the two held in this position by inserting the batten. This step is repeated with adjoining warps until the left edge of the web is reached. By drawing in the weft in place of the batten, the line of twists (*a*) is made permanent. A second line of crosses (*b*) will be formed whenever warps are shifted back into their original positions. This is done by simply pulling the heddle forward and inserting a weft. This is the standard procedure for weaving fancy gauzes in Highland Guatemala, and was that used in Peru also.

A second method of weaving gauze was observed by O'Neale in Highland Guatemala, and is illustrated in our figure 28, C, 1. It may have been known in the prehistoric Southwest. The process is described by O'Neale as follows:

> At San Pedro Carcha the stick loom is standard in all of its parts. The heddle loops encircle the even-numbered warps just as they do for the most simple plain weaving but with this difference: instead of drawing up Warp 2 between Warps 1 and 3 (counting from the right), the heddle loops

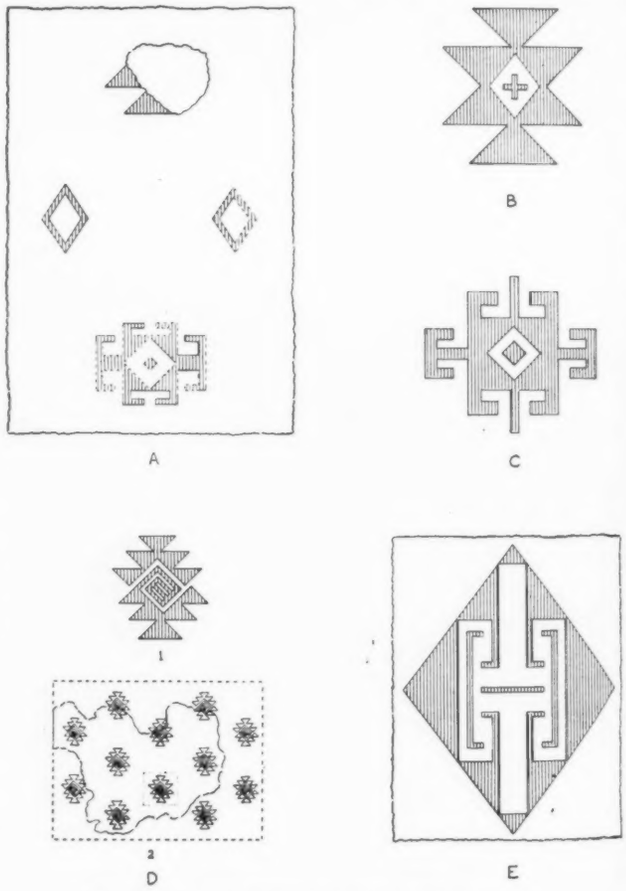


FIG. 24. Unit designs in weft-wrap openwork.

A. Design distribution on a fragment from Cottonwood, Verde Valley. (ASM 26236.) The cloth measures 15½" from top to bottom warp selvage.
B. Bear Creek Cave. (USNM 246123c.)
C. Child's poncho. Ventana Cave, Burial #22.
D. Unit design (1) and its distribution (2) on what was probably the weft-wrap border of a plain weave cloth. Casa Grande (USNM 252105. Hough, 1914: 78–79, fig. 163.)
E. Design on a 6¾" square cloth from Graham County, Arizona (USNM 363987–8.)

[39] See Appendix C, chart 4: Gauze weave in combination with weft-wrap openwork: ASM 23295, Kayenta area; ASM Ventana Cave, Burial #22; NPS–MC 36 and 37 (one cloth), Montezuma Castle; NPS–T 9/591, Tonto; Haury, 1934: 97 and pl. LX, *b*, Tonto. Gauze weave alone: USNM 232153, Bear Creek Cave; USNM 232153*a*, Bear Creek Cave; Haury, 1934: 97, Camp Verde Salt Mine; Hough, 1914: 80, lists a piece from a cave near Solomonsville.

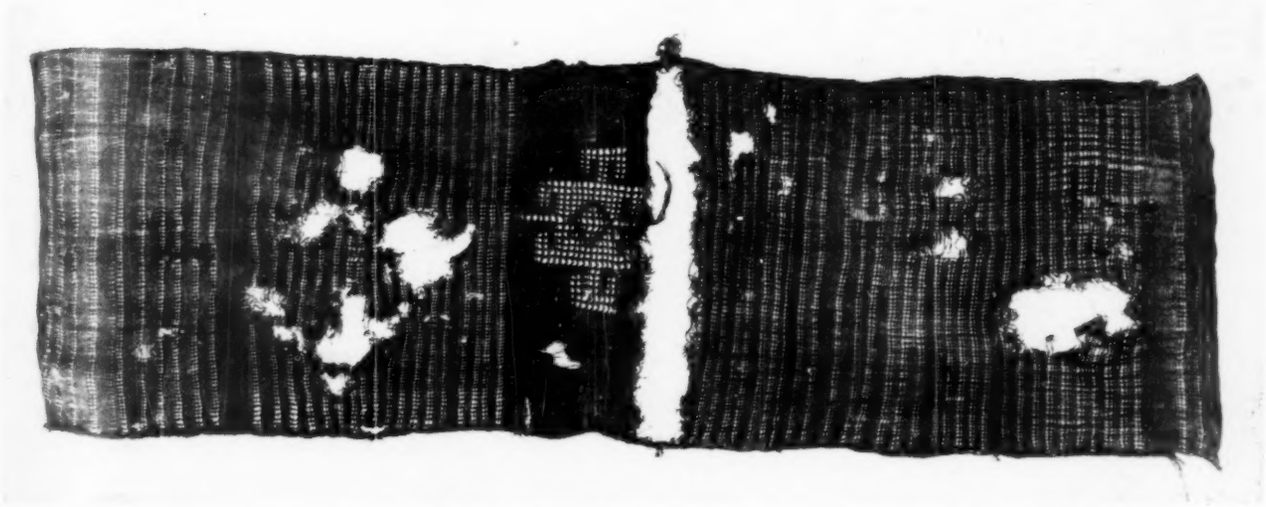


FIG. 25. A child's poncho from Ventana Cave, Burial #22, done in gauze weave with a unit design in weft-wrap openwork on the chest. (Dimensions: 28" by 8⅝". Photo by E. B. Sayles.)

draw up Warp 2 between 3 and 5; Warp 4 comes up between 5 and 7, Warp 6 between 7 and 9. . . . That is, when the heddle is raised, all the even-numbered yarns are drawn to the left of their adjacent odd-numbered neighbors. Then the sword is inserted, the shed formed, and a pick of weft put through to secure the cross. But on the next pick,

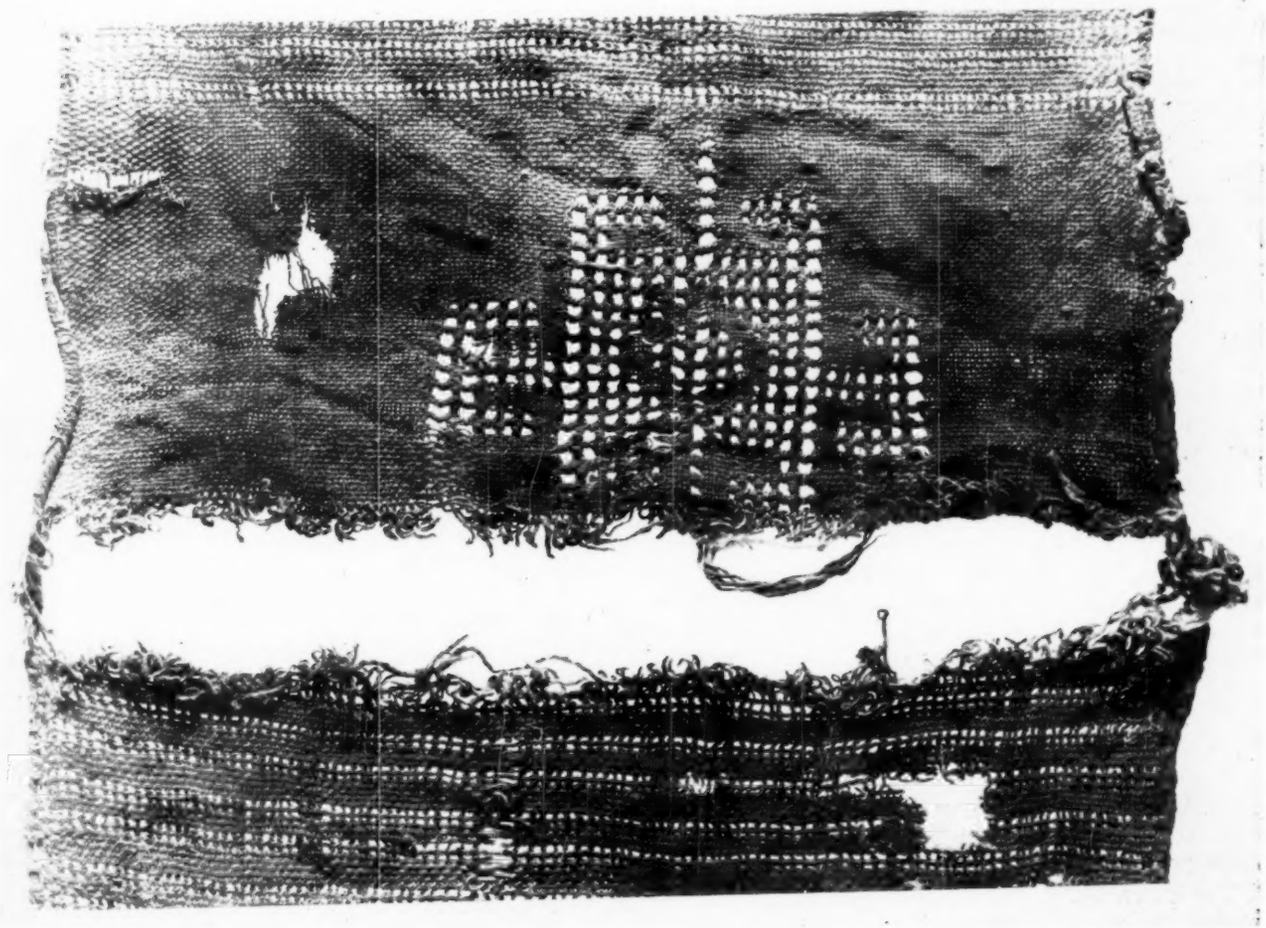


FIG. 26. Detail of weft-wrap openwork unit pattern on child's poncho from Ventana Cave. (Photo by E. B. Sayles.)

FIG. 27. Fragment of weft-wrap openwork cloth, 4¾" by 14½". Probably from the Kayenta area. (ASM 24026. Photo by E. B. Sayles.)

when the shed roll is brought forward, all the evens are forced back to their original positions, and they are secured in them by the weft. These are the only two changes in plain gauze weaving. If the weaver wishes to make a section without the gauze crossings, she must remove the heddle and put another in its place, one which brings the odds up in the vertical plane. One weaver, asked to change to plain weaving for one narrow stripe, picked up each yarn separately.[40]

Various effects may be achieved in gauze weave, based on the way in which openwork lines are grouped or spaced. Three variations are illustrated in figure 28, A, B, and D. Figure 28, A shows the relationship of openwork lines on fragments from Montezuma Castle. Here three to five weft picks were inserted between the first crossing of warps and their re-crossing. This took a certain amount of finger manipulation of the warps, since the weaver could never pull the heddle forward without creating his second line of crosses. Having secured the first line of crosses with a weft pick, he returned the weft through the web with shed rod still forward. For the third passage of weft, he had to bring forward each heddle-controlled weft with his fingers, keeping each one warp to the right of its normal position. In other words he had to repeat the process used to create the first line of crosses. The fourth weft pick is inserted with shed rod forward, the fifth by the finger process, and so on until the heddle is pulled and the re-crossing accomplished.

Slightly more elaborate is the effect achieved on a Tonto fragment (fig. 28, B) wherein warps are crossed, a weft pick run through, and warps returned to normal positions. This is done every five weft picks. The same technique is used on the Ventana Cave poncho, but openwork rows are less evenly spaced.

The exceptionally lacey texture of Bear Creek Cave fragments results from the weaving in of several consecutive rows of gauze (fig. 28, D). A plain weave border on one of the fragments shows extra wefts picked in from selvage to edge of gauze section and back to balance the spaces formed between regular wefts in the gauze area by warp crosses.[41]

[40] O'Neale, 1945: 74–75.

The Uses of Openwork Textiles

Few openwork textiles are identifiable to use. There is the child's poncho from Ventana Cave, a sash (?) from Tonto, and a fragment of weft-wrap from Canyon Creek described as part of a bag. The openwork piece from Mule Creek Cave, an 8-inch-wide cloth, folded and sewed up the side, may have been the sleeve of a small garment, or a quiver.[42]

In addition to these articles, there are three rectangular cloths. The first is a complete weft-wrap article, 15⅜ × 12½ inches, from Nitsie Canyon. About half the size of this are the 6¾ inch square of weft-wrap from Graham County and the rectangular gauze cloth, 5¼ × 6 inches, from a cave near Solomonsville. The suggestion is made on p. 617 that these rectangular cloths may have been aprons worn with two corners fastened to the center front of a belt. A weft-wrap cloth from Cottonwood, with a warp stretch of 15½ inches, might have resembled the Nitsie piece, or might possibly have been a kilt (figs. 22, A; 24, A, E).[43]

[41] USNM 232153. See also Hough, 1914: 80, fig. 166. (Here the catalogue number is listed as 252153.) Hough has reversed warps and wefts in his drawing of the piece, according to my analysis. Unfortunately my notes do not give the clear statement of selvage construction needed to determine exactly how the extra wefts were worked into the plain weave border.

[42] ASM VC B#22, Ventana Cave; Haury, 1934: 97 and pl. LX, *b*, Tonto; *ibid.*, 93, fig. 19, Canyon Creek; PM 34-12-10/2738, Mule Creek Cave.

[43] ASM 2151, Nitsie Canyon; ASM 26236, Cottonwood, Verde Valley; USNM 363987–8, Graham County, Arizona; Hough, 1914: 80, Solomonsville, Arizona.

Weft-wrap appears to have been applied to the border areas of plain weave and gauze weave cloths. An example of this is the gauze weave sash (?) from Tonto Monument. According to Hough, the weft-wrap found by Fewkes at Casa Grande represented the border area of a plain weave cloth, possibly a manta (fig. 24, D).[44]

The Distribution and History of Weft-wrap Openwork and Gauze Weave

Seven pieces of weft-wrap are definitely recorded from three Pueblo III Anasazi sites: Nitsie Canyon, White House, and Kiet Siel. In addition, there is one more example doubtfully assigned to Canyon de Chelly and four (one in combination with gauze weave) thought to come from the "Kayenta area," making a possible total of twelve scraps from the Chinlee and Nitsie drainages. Weft-wrap and gauze are conspicuously lacking in existing collections from further north, northeast, or east in the Pueblo area. Put in another way, of the more than thirty northern sites yielding cotton fabrics, only three to seven contained openwork and these are concentrated in the western part of the Anasazi area. The Nitsie Canyon piece has an Anasazi pattern (p. 631) indicating local manufacture. The rest may be trade goods.

By contrast, thirty-five pieces come from Sinagua, Salado, Eastern Mogollon, and Hohokam sites. Nearly every village from which textiles were taken in central and southern Arizona and southwestern New Mexico yielded weft-wrap or gauze.

The earliest example of weft-wrap comes from the Sedentary Period (900–1100) at Snaketown. Openwork textiles from Bear Creek Cave, Doolittle Cave, and Mule Creek Cave probably date between 1000 and 1200. Weft-wrap and gauze were very popular techniques by Pueblo III and IV times in central and southern Arizona as evidenced by examples from Wupatki, several sites in the Upper Verde Valley, Tonto Monument, Canyon Creek, Casa Grande, and Ventana Cave.

Briefly, weft-wrap openwork and gauze weaves were practiced by Hohokam, Eastern Mogollon, Salado, and Sinagua, but not to any great extent by the Anasazi peoples, at least prior to 1300. Hence, within the Southwest weft-wrap, and its companion technique, gauze, are seen to have definite southern affinities. Something very like weft-wrap was found in the Sacred Cenote at Chichén Itzá, Yucatan. Curiously enough it has not been recorded for Peru. Notes on certain contemporary Mexican weave processes, while suggestive of weft-wrapping, are not sufficiently detailed to determine just what technique is meant.[45] Gauze, however, was an important technique in Peru and is (and probably was) widespread in Mexico and Guatemala.

Judging from the evidence at hand, gauze, and perhaps the basic idea of weft-wrap, reached the Hohokam probably from the west coast of Mexico by 1000 or earlier. Knowledge of openwork weaves was passed on to the Eastern Mogollon and carried north to Wupatki by 1100. These techniques penetrated the southwestern corner of the Anasazi area perhaps principally as trade goods. Weft-wrap was the prevailing fashion in fancy weaves between 1300 and 1400 among the Salado and Sinagua as a result of Hohokam contacts.

Openwork techniques may have become popular among the Pueblo IV Anasazi, as a result of Sinagua and Salado influences reaching them at that time. There is a suggestion of this in the clothing shown on

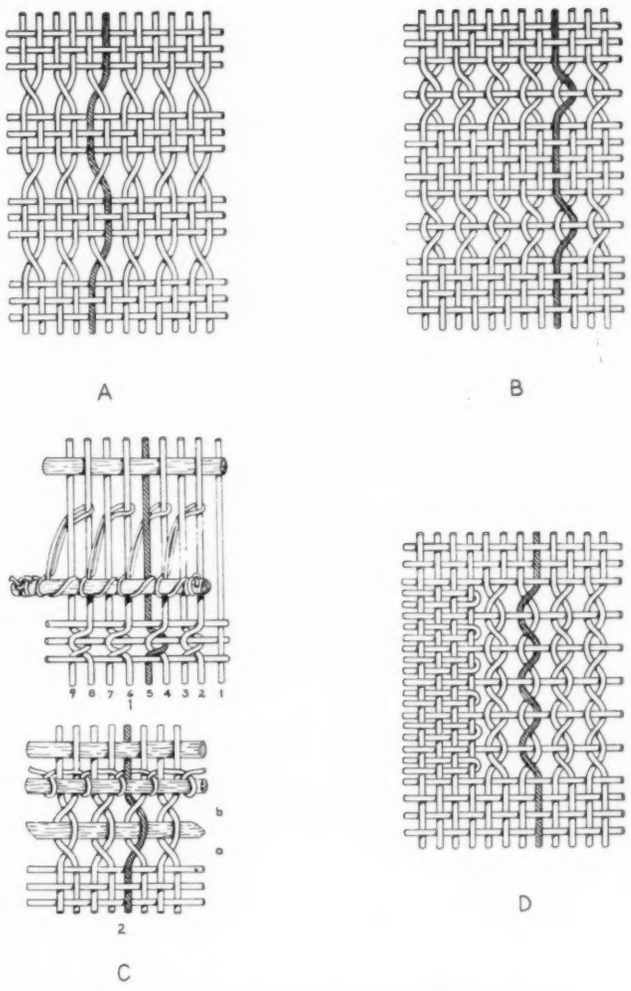
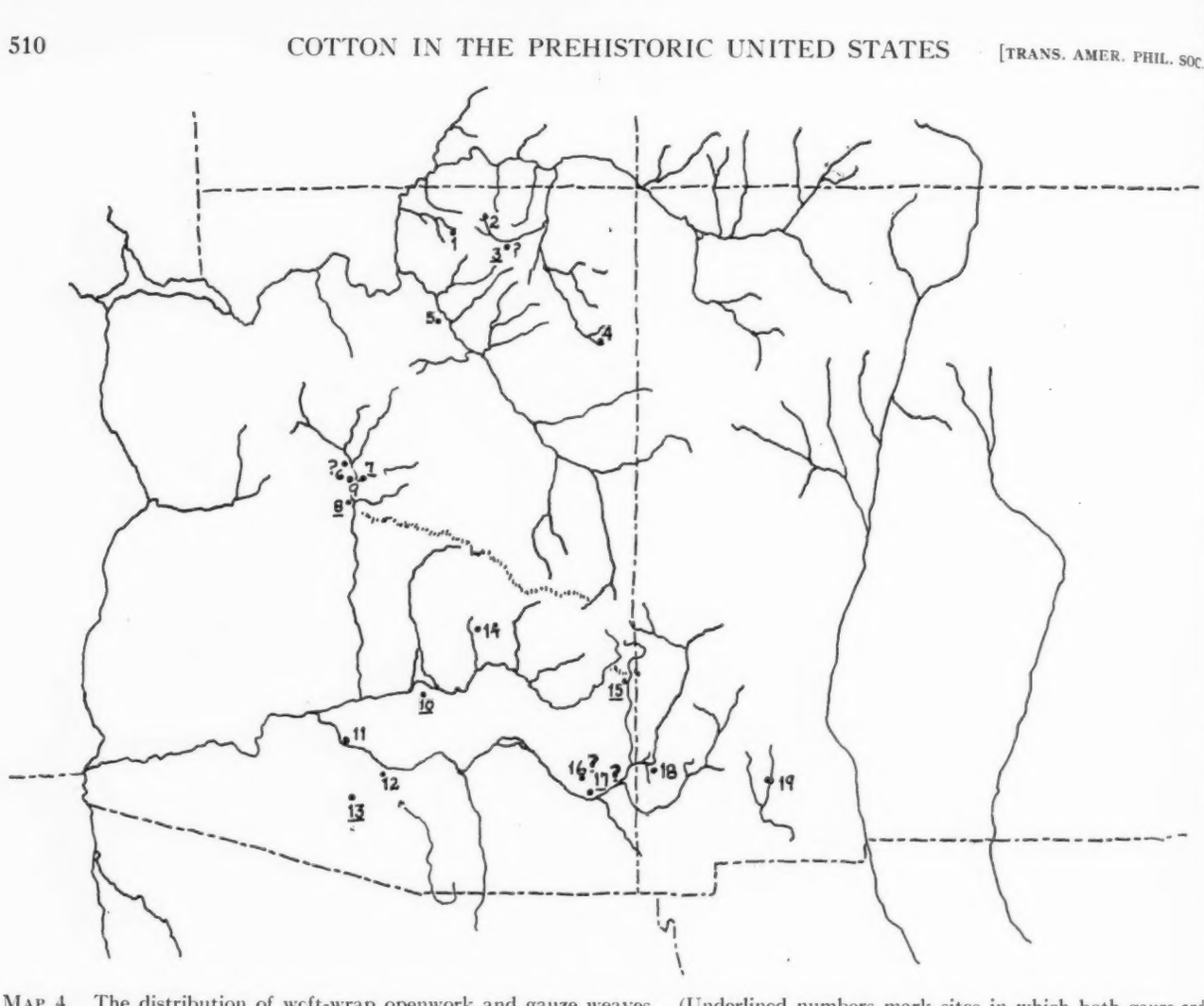


FIG. 28. Gauze weave techniques.

A. Montezuma Castle. (NPS–MC 36 and 37.)
B. Tonto. (NPS–T 9/591.)
C. Warp manipulation in gauze weave. (1) Heddle strung so as to cause crossing of adjacent warps automatically when pulled. (2) Heddle strung for plain weave and gauze weave crosses effected with the fingers.
D. Bear Creek Cave. (USNM 232153. Hough, 1914: 80, fig. 166.)

[44] Hough, 1914: 78–79, fig. 163.
[45] Cordry and Cordry, 1940: 40.



MAP 4. The distribution of weft-wrap openwork and gauze weaves. (Underlined numbers mark sites in which both gauze and weft-wrap were found. Question marks indicate doubtful proveniences.) (1) Cave Town Ruin, Nitsie Canyon. (2) Kiet Siel. (3) Kayenta area. (4) White House and Canyon de Chelly. (5) Wupatki. (6) Verde Valley. (7) Montezuma Castle. (8) Verde Valley Salt Mine. (9) Cottonwood. (10) Tonto. (11) Snaketown. (12) Casa Grande. (13) Ventana Cave. (14) Canyon Creek. (15) Bear Creek Cave. (16) Graham County. (17) Solomonsville. (18) Mule Creek Cave. (19) Doolittle Cave.

figures in two of the Kawaika-a murals. The murals in question depict a shirt and a kilt decorated with narrow lines of dots which criss-cross to form large diamond-shaped areas.[46] The center of each diamond is filled with more dots. These garments are represented as being white, with the design in black. They may be intended to show weft-wrap, gauze, braid or twine-plaiting.

There is a Spanish description of cloth at Zuni in 1540 which may refer to weft-wrap.[47] This is pure speculation. However, some of the contemporary Rio Grande Pueblo embroidery designs are very similar to the unit patterns illustrated in figure 24 (fig. 141, A, B). These suggest a carry-over from the extinct technique, and hint that weft-wrap cloths may once have been present among the Pueblo peoples of New Mexico.

[46] Smith, 1952*b*: fig. 24, *d*, *g*. See also our fig. 142, B.
[47] Winship, 1896: 562.

BROCADES AND EMBROIDERIES

Definitions

Brocade. A brocaded fabric is one in which geometrical designs are built up as the weave progresses by alternating a pick of decorative yarn with a pick of basic weft.

Embroidery. In embroidery, designs are created on a woven fabric, after its removal from the loom, by the insertion of decorative threads with a needle. Embroidery is a stitchery technique, not a loom weave process.

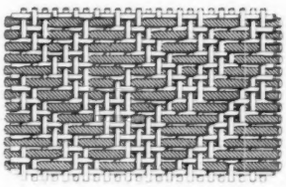
Technical Descriptions

Introductory Remarks

This discussion is based on the consideration of twenty-four examples, twenty-one of which are classed as embroidery and three as brocade (Appendix C, chart 5, *a* and *b*).

Brocaded and embroidered cloths are easily confused. For this reason, the two classes of fabrics are described in the same section. The distinction between brocades and embroideries lies, fundamentally, in the methods of their manufacture, and not in the appearance of the finished pieces. Brocade is a *weave* technique, accomplished while the cloth is under construction on the loom. Embroidery is the process of embellishing a completed cloth, after its removal from the loom, by drawing in decorative yarns with a needle.[48] The fabrics produced by these two processes may resemble one another so closely that there is literally no way of telling which is brocade and which embroidery unless one has seen the pieces being made. True, certain technical features *must* be present if the piece is a brocade. Basically, these are two in number. First, a decorative yarn may never move out of position between two given structural wefts. It will always parallel construction wefts. Second, the decorative yarn will never split warp or weft threads, as yarn inserted with an embroidery needle might, but will always pass between them. These conditions are also met by certain simple embroidery techniques, and therein lies the confusion.

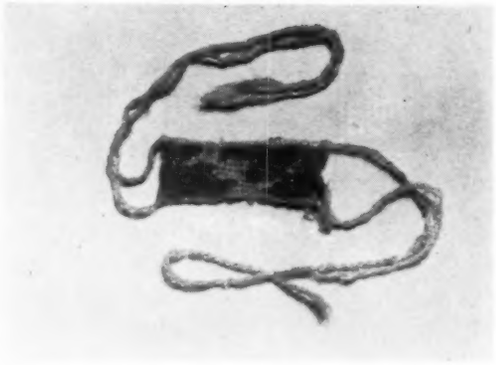
A



B

FIG. 29. A brocaded fabric from the Clear Creek group of cavate lodges near Camp Verde.

A. The design, worked in brown on a white ground cloth. The area enclosed in the dotted rectangle is enlarged in B to show the distribution of the brocade stitches which form that part of the pattern. (Width 7⅜". AMNH 29.1/5508.)



A

B

FIG. 30. A. A miniature cigaret sash embroidered in blue and brown. Cave near Olberg. Width about 2". (Photo by Museum of Northern Arizona.) B. A fragment of brocaded cloth fastened to a small stick. Canyon Creek. (GP 17130. Photo by Gila Pueblo.)

While I have classified three fragments as brocades and twenty-one as embroideries in the following discussion, it must be kept in mind that there is considerable doubt as to the method used in making several of the latter pieces.

Brocade

The three examples of brocade are: a bag from a site in Clear Creek, Verde Valley,[49] a fragment of cloth from the Clear Creek group of cavate lodges near Camp

[48] O'Neale, 1945: 58–67.

[49] AMNH 14/228. I have not seen this piece, but call it brocade on the basis of notes and a photograph furnished by the Museum of Northern Arizona.

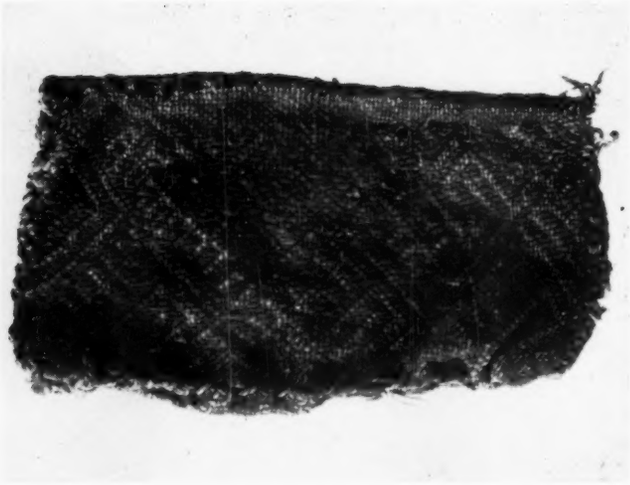


FIG. 31. Bag from the Verde Valley, made by folding a brocaded cloth and seaming two sides. Fold is at top of photograph, and mouth of bag at right. Length from bottom to mouth, 5½". (AMNH 14/228. Photo by Museum of Northern Arizona.)

Verde; and a small piece of fabric from the Canyon Creek Ruin.[50]

In weaving these, the loom was strung for regular plain weave. Designs were made by inserting a decorative yarn after each pick of plain construction weft. This yarn was carried from edge to edge of the web floating freely over and under groups of warps in accordance with the dictates of the design. The over-all pattern was built up from floats of varying lengths on the surface of the cloth. Such a process is called "finger-weaving," or "picking-in," as the decorative wefts are inserted without the aid of heddles.[51] All three brocades are patterned in geometric designs worked out with brown yarns on a plain white ground cloth.

The Clear Creek fragment has a complete width of 7⅜ inches. Both construction and design wefts loop between selvage threads at the edges of the cloth, an excellent indication that the design wefts were inserted during weaving. The pattern consists of bands of triangular points running diagonally to warp and weft. These bands angle from diamond-shaped units, which encompass an arrangement of interlocking hooks (fig. 29).

A small bit of cloth attached to a stick, the Canyon Creek brocade was found with an infant burial, and may be the remains of a cradle band (see p. 621). The design is similar to that just described (fig. 30, *b*).

The Clear Creek bag was made from a cloth 5½ inches wide (weft stretch) by 6 inches long (warp stretch), folded on its weft axis to bring the warp selvages together and with seams across the bottom and up one side. It bears a pattern essentially the same as that of the other two brocades, except that small rectangles replace the triangular points (fig. 31).

The Clear Creek brocades were woven in the form of narrow bands, and this was almost certainly true of the Canyon Creek piece also.

There are certain cloths which, not embroideries and not brocaded plain weaves, resemble the pieces just described in one way or another. There is a striking similarity, for example, between the brocades and the weft-float cloths from Montezuma Castle described on pp. 559–560. This likeness results from the design, the method of building that design from weft floats, and the fact that the Montezuma pieces were woven as narrow bands. The idea of weaving in extra decorative yarns along with basic wefts is expressed in brocaded twills and weft-floats from Kiet Siel, Grand Gulch, and White House (pp. 556–558, 560–561).

Embroidery

Four stitchery techniques are found on the twenty-one embroidery fragments. These are: a simple running-stitch; twine-stitch; double running-stitch; and wrap-stitch. In all cases the embroidery was done on plain weave cloth, generally white. The decorative yarns were always inserted in warp-weft interstices, never splitting a thread. They nearly always parallel the wefts. Two-ply yarns were used in running-stitch and twine-stitch embroidery, single-ply yarns in more elaborate stitchery. Whether one- or two-ply, the embroidery yarns are softer and thicker than the threads of the ground cloth.

Twine-stitch and running-stitch are standard darning techniques (see pp. 574–575). It is sometimes hard to tell whether they were inserted as decoration or to reinforce a worn fabric. A piece has been called embroidery only if the ground cloth is in good condition and the stitching seems to serve no useful purpose. An exception to this is the badly worn fragment from Gourd Cave (ASM 3013, described below) stitched in a twill pattern which seems unnecesarily elaborate for a simple darn, although it may have been just that.

Running-stitch embroidery.—This is the simplest of the embroidery techniques, and the one most easily confused with brocade. The yarn is carried over and under the cloth in stitches of any desired length (fig. 32, D and G). These stitches almost always lie parallel to the wefts, as the floats of brocaded cloth.

Nine fragments, from White House, Kiet Siel, Navaho National Monument, Gourd Cave, and Nitsie Canyon, are decorated by running-stitch embroidery.[52] Three of these also exhibit some twine-stitch. The fragments from White House and Kiet Siel show what

[50] AMNH 29.1/5508, Camp Verde. See also: Morris, 1928: 94–95. GP 17130, Canyon Creek. See also: Haury, 1934: 98.

[51] O'Neale. 1945: 60–61.

[52] See Appendix C, chart 5, *a*: AMNH 29.1/2897D and 29.1/8428, White House. ASM 2150, 2990, 2991 and 3013, Gourd Cave. ASM 6601 and an unmarked fragment, Nitsie Canyon. MNA 695/2519.M250, Kiet Siel. USNM 312259, Navaho National Monument.

appear to be crude attempts at decoration by running in a single length of thread. Compared to them the five pieces from Gourd Cave and Nitsie Canyon are elaborate in design. It is these cloths which may, in fact, be brocades rather than running-stitch embroideries. They are classed as the latter because twine-stitch, which I deem an embroidery technique, appears with running-stitch on two fragments. If we assume that all the decoration was carried out at one time, embroidery seems the more logical process. On the other hand, the patterns, so closely resembling twills, could easily have been executed by loom weaving, and argue strongly for brocade.

The simplest decoration is that on ASM 2990. Two-ply white embroidery yarn is carried back and forth nine times across a space $3\frac{1}{4}$ inches wide. Each row of stitching is separated from the next by one weft pick. The yarn passes over and under the same warp pairs in every row. Flanking the embroidered area are single lines of twine-stitch (fig. 32, D).

The other four Gourd Cave-Nitsie Canyon fragments are patterned in what may be called "false twill." On three of these (ASM 2150, 2991 and 6601) the decorative stitches follow the rhythm of over-three, under-three diamond twill (figs. 32, G, 33, and 34, A). Yarns are white on two of the pieces. In the case of the third fragment (ASM 6601) there are alternate inch-wide bands of blue and white embroidery.

The remaining "false twill" running-stitch embroidery (ASM 3013) is unique in that the stitches follow an over-two under-two diagonal twill rhythm. The narrow band of "false-twill" is flanked by several rows

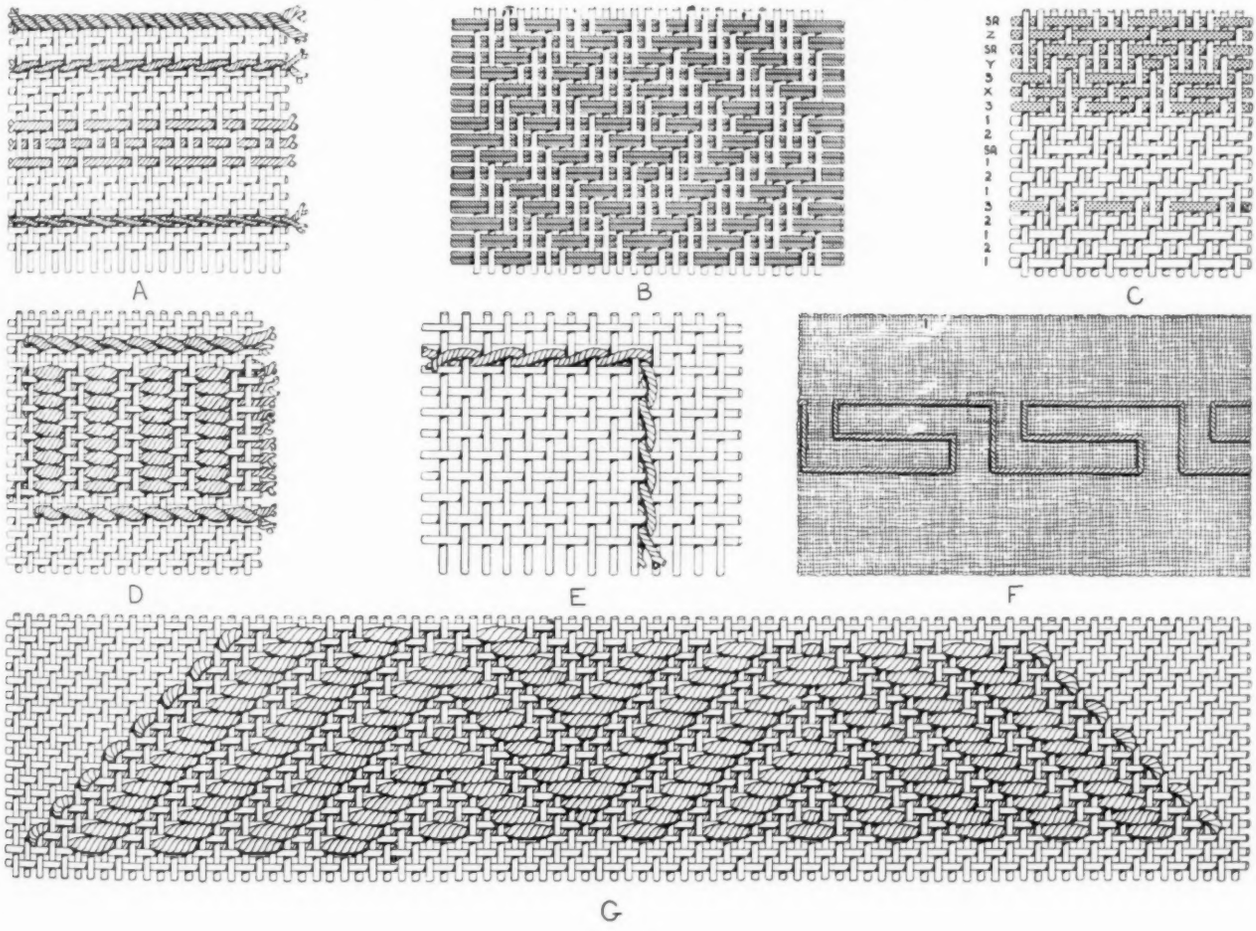


FIG. 32.

A. Weft-float pattern weave and twine-stitch embroidery. White House. (AMNH 29.1/7897D.)
B. Weft-float pattern weave. Montezuma Castle. (NPS–MC 18.)
C. Weft-float or irregular twill. Lenaki. (MNA 712/2630 R3.7b.)
D. Portion of a band of running-stitch embroidery flanked by lines of twine-stitch. Embroidered unit $\frac{11}{16}$" wide, $3\frac{1}{4}$" long. Gourd Cave. (ASM 2990.)
E, F. Twine-stitch embroidery forming a meander pattern on a cloth from White House. E is an enlarged drawing showing stitching in the area enclosed by the dotted rectangle on F. Each "hook" is about 2" wide. (AMNH 29.1/7542b.)
G. Running-stitch embroidery simulating over-3 under-3 diamond twill. Embroidered unit $\frac{7}{8}$" wide, 4" long at base. Gourd Cave. (ASM 2991.)

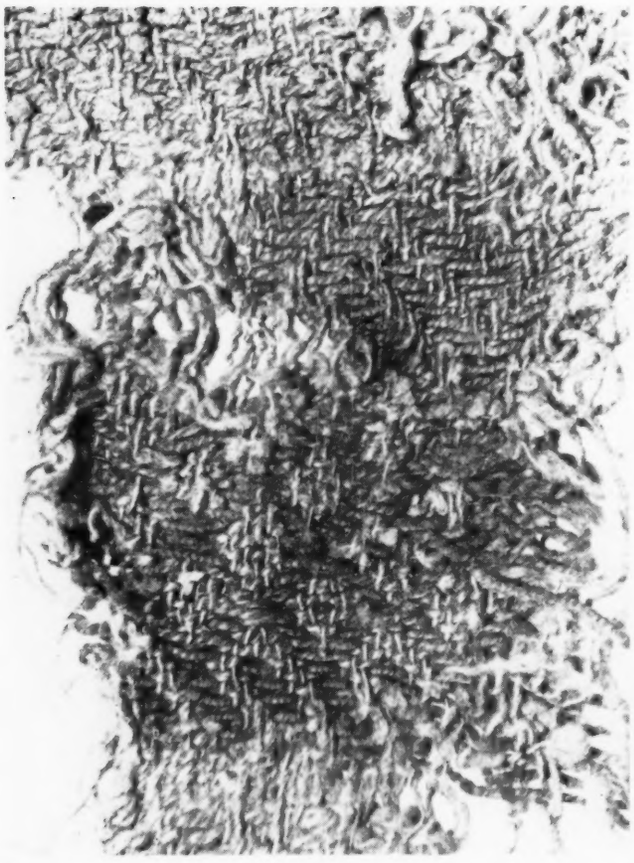


FIG. 33. A diamond twill pattern worked in running-stitch embroidery with blue and white yarns. Nitsie Canyon. (ASM 6601. Photo by E. B. Sayles.)

of twine-stitch embroidery. It is the stitchery on this fragment which may in fact be darning rather than embroidery (fig. 34, B; 90, D).

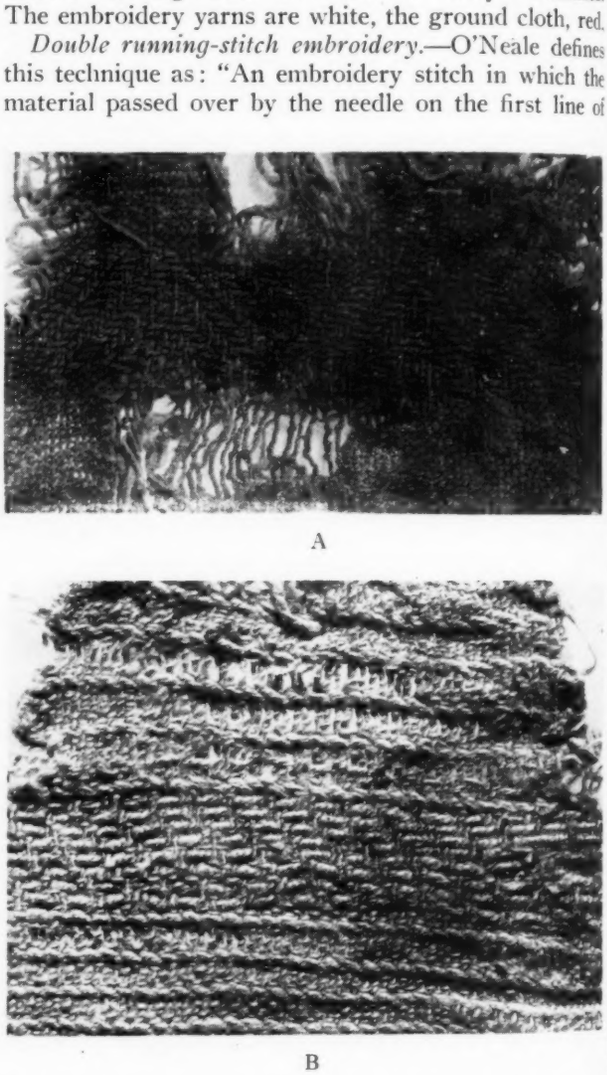
Twine-stitch embroidery.—Each line of twine-stitch embroidery is composed of two yarns. These yarns twist a half-turn about each other at points of insertion, enclosing two or more warps (or wefts) (fig. 32, E, F). The yarns were not inserted simultaneously. Instead, a thread was run through the cloth for a given distance over and under two or more warps or wefts at a time. It was then doubled back and passed along the same course, this time crossing over the warp or weft sets which had been skipped on its first passage. In so doing, the needle was inserted first at one side of the original line of stitches, and then at the other, to give the effect of two threads twisting around foundation elements as in twined basketry.

Twine-stitch, in addition to its appearance as a darning and embroidery technique, is sometimes found as reinforcement just inside a selvage (p. 577).

There are eleven fragments illustrating the use of twine-stitch as a decorative agent.[53] Three of these were also listed with running-stitch embroideries. All come from Anasazi sites—Grand Gulch, Poncho House, or the Lower Chinlee Valley, White House, Gourd Cave, Kiet Siel, and Navaho National Monument.

In some cases embroidery threads are of contrasting color to the web, but usually both cloth and threads are white. The stitchery ordinarily appears in rows paralleling the weft picks, though this is not always the case. Designs are not apparent, with the exception of that on a fragment from White House (AMNH 29.1/7542b, Fig. 32, F). In this case lines of stitching form a large meander having about three "hooks" every six inches. The embroidery yarns are white, the ground cloth, red.

Double running-stitch embroidery.—O'Neale defines this technique as: "An embroidery stitch in which the material passed over by the needle on the first line of



A

B

FIG. 34. A. A diamond twill pattern in running-stitch embroidery. Gourd Cave. (ASM 2991.) B. Embroidery or darning in twine-stitch and running-stitch. Gourd Cave. (ASM 3013.) (Photos by E. B. Sayles.)

[53] See Appendix C, chart 5, *a*: AMNH H/12587 (I52), Grand Gulch. AMNH H/14360, Poncho House or Lower Chinlee Valley. AMNH H/15736, Grand Gulch or Kayenta. AMNH 29.1/2897D; 29.1/7542*a* & *b*; 29.1/7543; 29.1/7757 and 29.1/7897*b*, *c*, White House. ASM 2990, Gourd Cave. MNA 695/2519.M229*c*, Kiet Siel. USNM 312259, Navaho National Monument.

running stitches is covered by a second line." [54] The yarns do not twist about each other on their return passage as in the twine-stitch embroidery just described. The same technique on Old World fabrics is called "punto scrito."

Examples of double running-stitch embroidery come from Walnut Canyon, Tonto National Monument, and a cave on the Pima Reservation.[55]

The Walnut Canyon fragment (figs. 35, D and 36) was decorated with a pattern of blue and brown interlocking keys. The brown threads have largely worn out of the piece. In executing the embroidery, a thread was run over sets of warps—each consisting usually of two or four warps—between two given wefts from one edge of a proposed design unit to the other. Here it was doubled back and crossed over the warp sets skipped on its first passage. These two steps were then repeated, so that four embroidery yarns lay between the two wefts. After shifting across one weft, the thread was run over the same warp sets, plus or minus two or four warps at one edge of the design unit. That edge thus became a slanting stepped line, oblique to warp and weft.

The same stitch was used on some Tonto fragments embroidered in soft, dark blue-green yarns (fig. 37, B). The yarns completely conceal the wefts of the cloth, giving the effect of slit tapestry. A small portion of weft selvage remains on one piece. Embroidery yarns clasp the selvage threads just as they would a regular warp, indicating the yarns were applied to the finished web (fig. 35, B). This selvage should be compared with that of the Clear Creek brocaded cloth described above (p. 512).

The double running-stitch appears to have been used in embroidering, with brown and blue threads, the miniature blanket from the Pima Reservation (fig. 30, *a*).

Wrap-stitch embroidery.—Wrap-stitch is a technique wherein the embroidery yarn is wrapped once or twice around a given number of warps between two wefts, then carried across one weft and wrapped about a second set of warps to left or right of the first. Yarns do not move freely back and forth across the web as in double running-stitch. Both techniques may be used on one cloth, the wrap-stitch forming narrow slanting lines, while broader points and keys are worked in double running-stitch (fig. 35, C). Wrap-stitch is the principle technique used in embroidering, with white thread, several pieces of white cloth from Tonto (NPS–T 9/712, 9/713 and others; fig. 37, A).

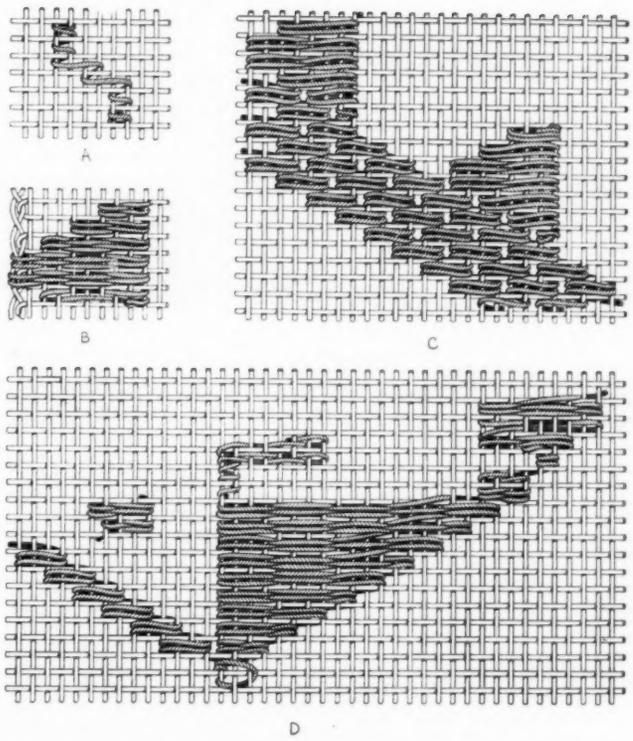


FIG. 35. Embroidery techniques. (The shading of the embroidery threads is not intended to indicate color, but simply helps differentiate thread from warp and weft.)

A. Wrap-stitch embroidery applied so as to form a narrow line design unit. Tonto. (NPS–T 9/713. White embroidery threads.)

B. Double running-stitch embroidery, the yarns clasping a completed selvage. Tonto. (NPS–T 9/441. Dark blue-green embroidery threads.)

C. Wrap-stitch embroidery used to create the parallel oblique lines of a design, with broader points worked in wrap-stitch and double running-stitch. Tonto. (NPS–T 9/712. White embroidery threads.)

D. The double running-stitch as used on an embroidered cloth from Walnut Canyon. (MNA 696/NA746.1. Blue or brown embroidery threads.)

The two surfaces of a cloth decorated by double running-stitch, wrap-stitch, or twine-stitch embroidery will be identical. In the case of brocades and simple running-stitch embroideries, all areas covered by design threads on one surface will be bare on the reverse surface. The pattern on the underside of such cloths is usually a negative of that on the right, or work, surface.

Designs on Brocaded and Embroidered Cloths

Most examples of twine-stitch and running-stitch embroidery in the collections are so crude that no designs are recognizable. Exceptions are the meander worked in twine-stitch, and the "false twill" patterns on running-stitch embroideries (brocades ?) from Nitsie Canyon. The latter offer an example of the Anasazi preoccupation with twilling (see pp. 565–567).

[54] O'Neale, 1937: 215.

[55] See Appendix C, chart 5, *a*: MNA 696/NA746.1, Walnut Canyon. NPS–T 9/441 and 9/442, Tonto National Monument. The third example, a sacred cigaret "sash" or "blanket," is in the collection of J. W. Simmons of Phoenix, Arizona. He found it in a cave near Olberg on the railroad southeast of Chandler, Arizona at the edge of the Pima Reservation. Loaned to the Museum of Northern Arizona for a brief period, it was identified as embroidery by Miss Katharine Bartlett, who kindly forwarded me a photograph of the piece.

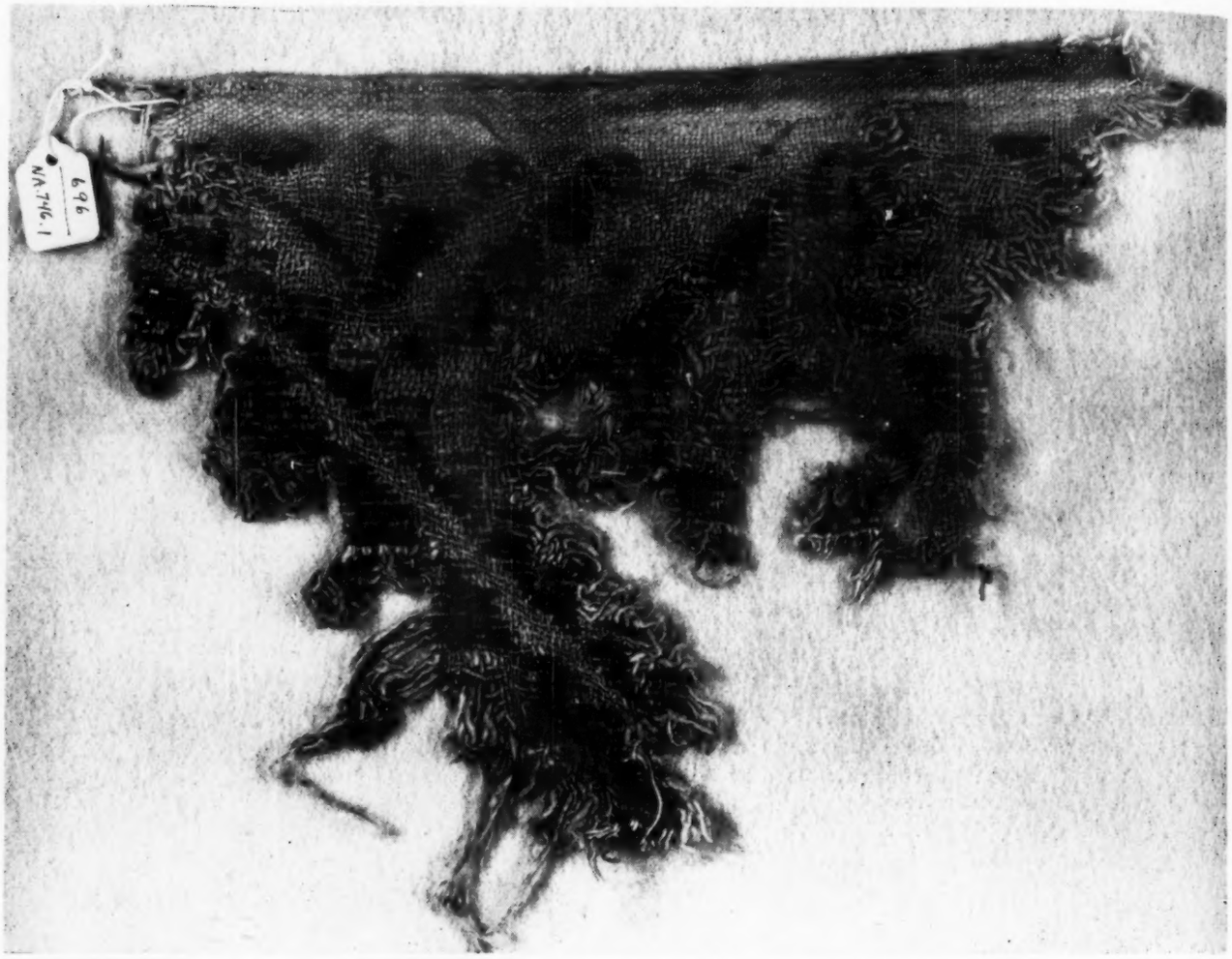


FIG. 36. An embroidered cloth from Walnut Canyon. Double running-stitch with brown and blue yarns. (MNA 696/NA746.1. Photo by Museum of Northern Arizona.)

Brocades, double running-stitch, and wrap-stitch embroideries are patterned in the same type of complex design, built up of small triangles and triangles with angled hooks arranged along oblique lines, which are found in certain other classes of Pueblo III and IV textiles, such as weft-wrap openwork, weft-float, interlocking twill tapestry, plain weave tapestry, and painted cloth.

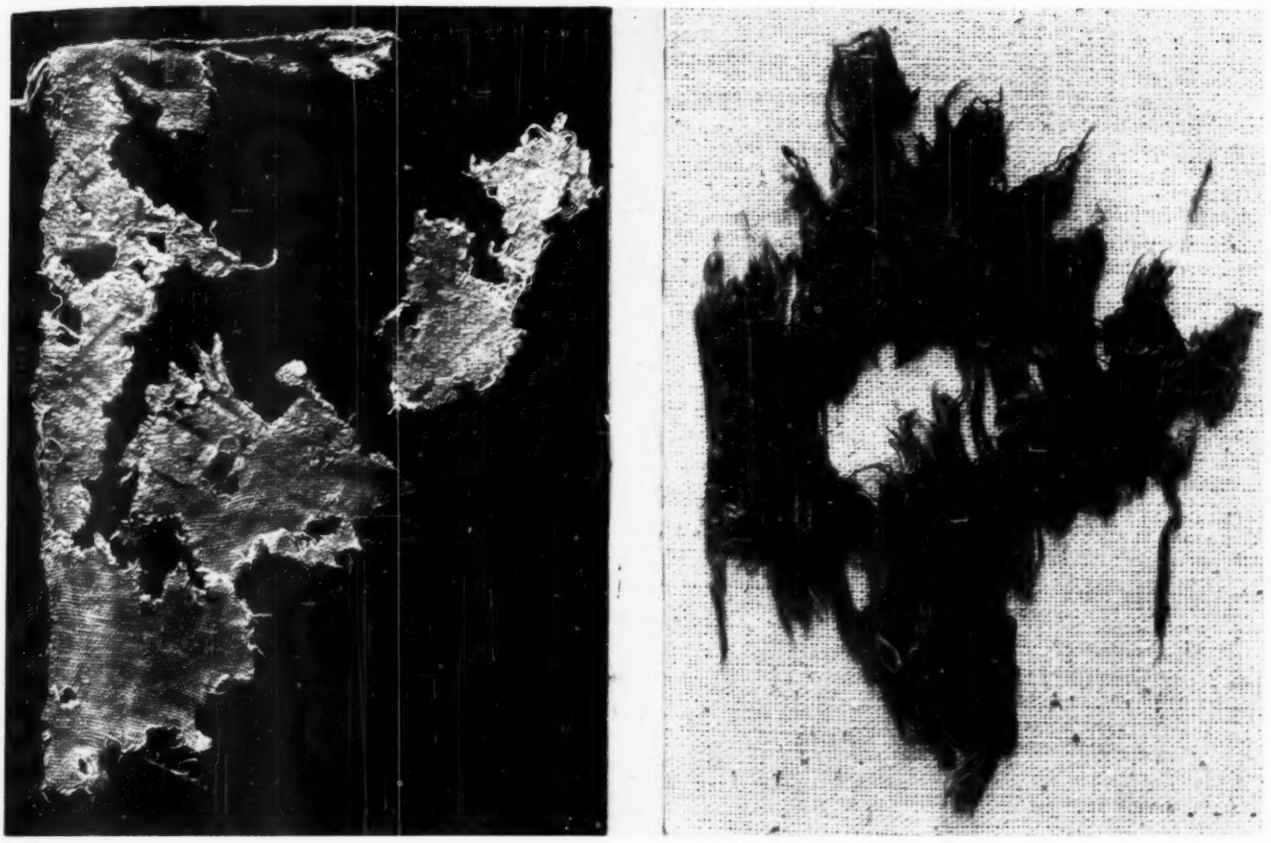
Solidly embroidered areas are separated and accented by narrow spaces, or lines, of undecorated cloth, a feature which foreshadows the "negative design" so typical of modern Pueblo embroideries. Dr. Mera defines this as: "A treatment of decorated areas wherein certain open spaces between the masses of whatever medium is applied to a surface, are so planned as to form patterns in themselves and which thus become of principal interest." [56] In this and other aspects of design, the brocades and embroideries of central and southern Arizona resemble textiles decorated by the same techniques from Pueblo IV sites in northwestern Chihuahua (fig. 38).

Since embroidery, like painting, is a form of decoration applied to cloth after its removal from the loom, the artist is free to work out any pattern he chooses. He need not be limited in his efforts, as in loom weaving, by technical considerations—notably that of rigid warps, crossed always at right angles by the weft. Actually, the conservative prehistoric craftsmen, so far as we know, took only slight advantage of this freedom, being content to reproduce in embroidery the angular, geometric motifs which had developed through weaving and basketry. The embroidery yarn seems to have been considered as little more than a supplementary weft.

The Uses of Brocaded and Embroidered Cloths

The three unquestionable examples of brocade hint strongly that this was a technique applied to rather narrow cloths. One of the pieces is in all probability a cradle band, and another a small bag. The third

[56] Mera, 1943: 9.



A B

FIG. 37. A. Embroidery with white yarns on a white ground cloth, the stitching oriented in a band 5½" wide paralleling the warp selvage. Tonto National Monument. (NPS–T 9/712.) B. A fragment of white cloth embroidered with dark blue-green yarns. Tonto National Monument. (NPS–T 9/441.) (Photos by National Park Service.)

could be the remains of a sash, a breech cloth end, or another small bag.

Unfortunately, we have no clues to the original dimensions of embroidered fragments. However, there is good evidence that the stitchery was applied as a decorative border along the warp selvages (or top and bottom edges) of plain weave cloths. The Walnut Canyon scrap was torn from one end of a cloth, and one of the white-on-white Tonto pieces (NPS–T 9/713) shows embroidery oriented in a narrow band 5½ inches wide, and parallel to the warp selvage. This brings to mind the placing of embroidered bands along the upper and lower borders of modern Pueblo blankets and the lower edges of Pueblo IV Hopi kilts.[57]

Contemporary Pueblo Indians have applied embroidery not only to blankets and kilts, but also to shirts, breech cloths, and some sashes and dance banners.

The Distribution and History of Brocades and Embroideries

Running-stitch and Twine-stitch Embroidery

Pueblo III Anasazi embroideries are all twine-stitch or running-stitch, and aside from the Nitsie Canyon "false twills," are very crude attempts at decoration, perhaps representing a local development from simple darning, which employed identical stitchery. The "false twills," which may qualify either as embroidery or brocade, do not relate closely to either technique as practiced farther south in the Pueblo area. We are probably safe in concluding that, prior to 1300, brocade and embroidery were well-developed arts only among the peoples south of the Mogollon Rim. (Brocaded twill and weft-float, found in Anasazi sites, are described on pages 556–558, 560–561.)

Brocades

From Canyon Creek Ruin and two sites in the Verde Valley, the three "true" brocades are probably all Pueblo IV products. The apparent rarity of the technique in the Southwest contrasts with its importance in prehistoric Peru. The extreme prevalence of brocade among contemporary Indians of Guatemala and Mexico probably reflects a pre-Spanish tradition there, also. Brocades are present in both the early (400) and recent (1300–1500) Chihuahua collections.[58] The technique as described here did not survive into historic times in

[57] Smith, 1952*b*: fig. 25. See also our figs. 140 and 142.

[58] See Appendix A, p. 658.

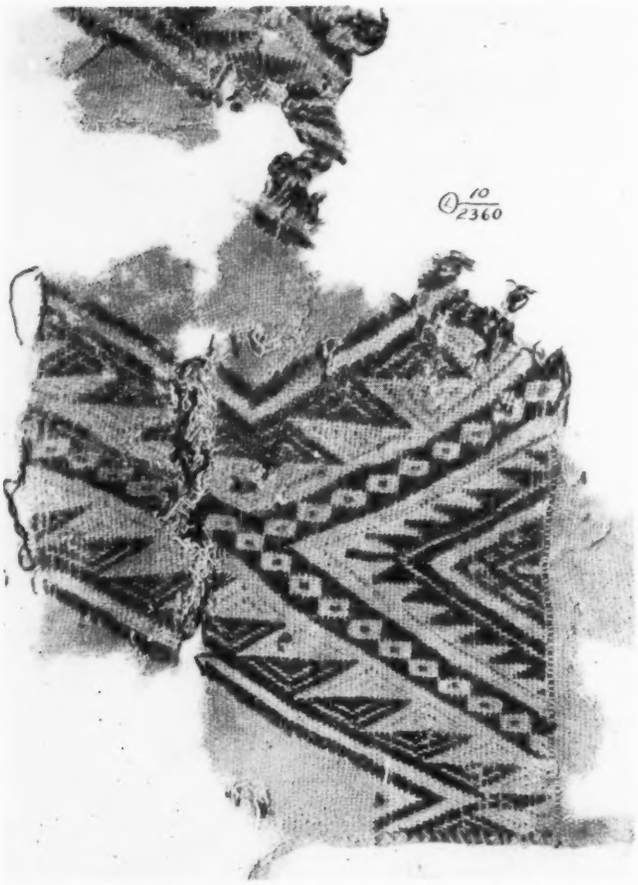


FIG. 38. Brocaded cotton cloth from a burial cave in Chihuahua, Mexico. The brocade wefts are dark blue, the ground cloth white. The photo is printed with warp threads in horizontal position. (Photo by Laboratory of Anthropology.)

the Southwest, the modern so-called Hopi "brocade" being quite different in character.[59] If brocade on plain weave was present in Chihuahua as early as 400 it is remarkable that it does not show up elsewhere in the Southwest until Pueblo IV. It appears, like embroidery, to be a late introduction from the west coast of Mexico entering via the Hohokam, although we should not rule out the possibility that it was an early Mogollon-Pueblo technique acquired from Chihuahua.

Embroidery [60]

Our scant evidence for true embroidery is scattered in time and space. The most northerly example, from Walnut Canyon, has been assigned by Dr. Colton to the Elden Focus of the early 1100's. This is a Focus containing strong southern influences. The Tonto pieces date to Pueblo IV, or about two hundred years later. The miniature manta from the Pima country cannot be assigned to any particular horizon. There are specimens, described as embroidery by Amsden, in the P. G. Gates collections of the Southwest Museum at Los Angeles.[61] These come from the Upper Gila drainage. I have no further information about them. The Jeddito murals furnish the only other archaeological evidence of embroidery in the Southwest, indicating its presence in northern Arizona *after* 1300.

No actual pieces of embroidered cloth remain from the years between 1400 and 1800, but Spanish accounts of Pueblo Indians between 1581 and 1583 describe what appear to have been garments embroidered with colored threads.[62] There is some doubt as to the technique under discussion since, as Mera points out, the term "bordado" used in the Spanish manuscripts has been employed within the last century in Latin American countries to designate decorative techniques other than needle work.[63] If the manuscripts do refer to embroidery, it means the art was known in the Rio Grande Pueblos in the 1500's if not before.

The best examples of historic Pueblo embroidery date between 1800 and 1880. After this time the art began to die out, and only a few ceremonial garments have been made since, chiefly at the Pueblos of Hopi, Zuni, and Acoma. Modern Indian school embroideries are quite different in character from older traditional forms.

Prehistoric and historic embroideries differ in certain respects. There is the substitution in the latter of wool yarns for cotton, and of commercial dyes for native vegetal colors. They are more complex in design and have combined one floral motif of European origin with pre-Spanish geometric elements. The most striking contrast lies, however, in the embroidery stitch itself. Somewhere along the line both wrap-stitch and double running-stitch were discarded, to be replaced by a sort of modified back-stitch with doubled thread, usually inserted parallel to the warps.[64] This stitch finds no counterpart prehistorically or historically in the New World or in the Old. So far as we know, it is unique to the historic Pueblo Indians.

Summarizing facts and conjecture concerning the origin and spread of embroidery in the Southwest, I should say that it was introduced into southern Arizona from the west coast of Mexico around 1100. The Hohokam passed it on to Sinagua and Salado. It was not adopted by the Pueblo III Anasazi, but sprang to a position of prominence in the Hopi country and probably New Mexico with the penetration of Sinagua and Salado into Anasazi territory after 1300. It has survived until today among the Puebloans as the major decorative medium for ceremonial attire.

PLAIN WEAVE TAPESTRY

Definitions

Tapestry.—Tapestry is a weave in which wefts are battened so closely together as to conceal the warps

[59] Douglas, 1938*a*.

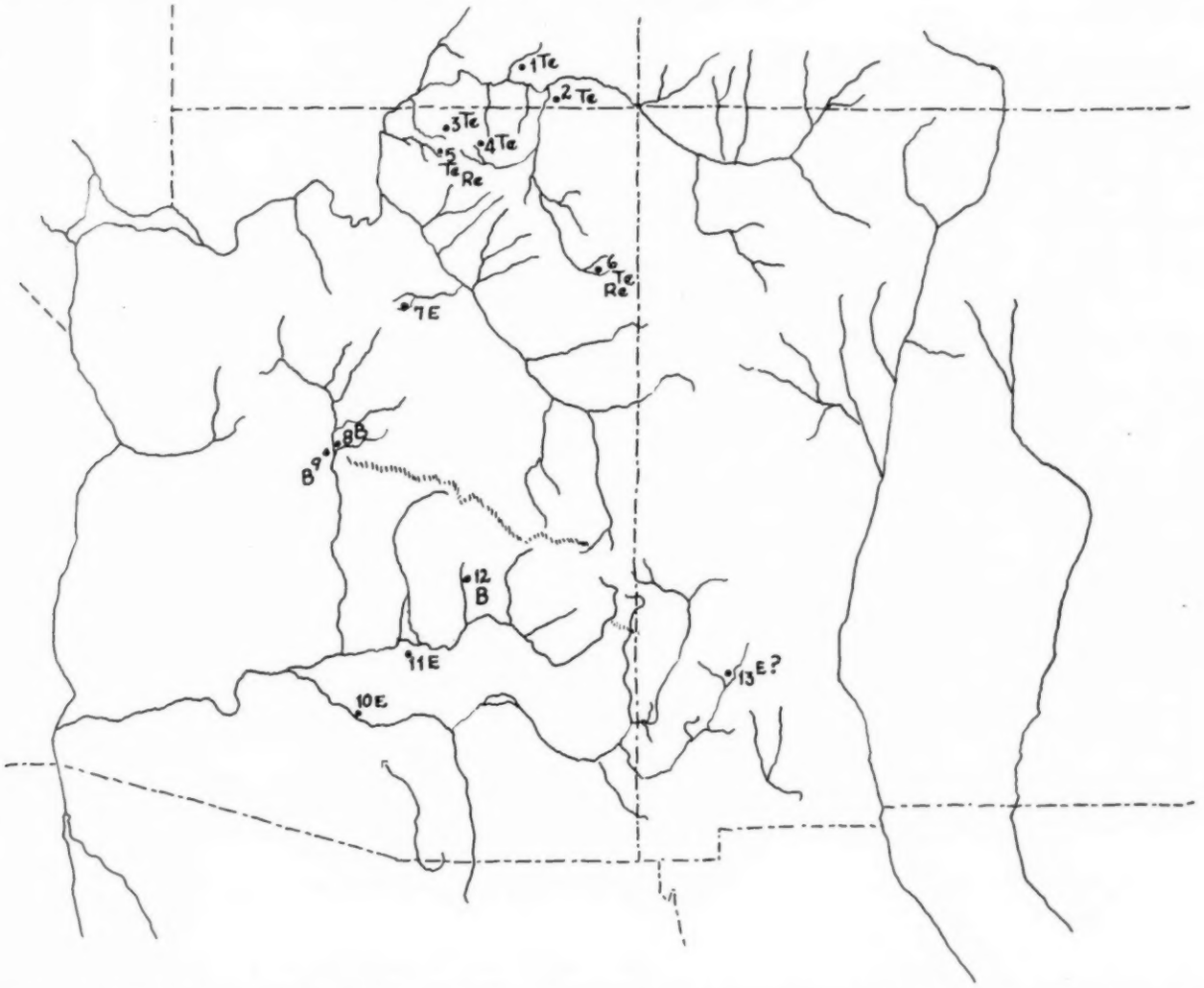
[60] A detailed study of Pueblo Indian embroidery will be found in Mera, 1943.

[61] Amsden, 1949: 117, footnote 8.

[62] Winship, 1896: 517, footnote.

[63] Mera, 1943: 3.

[64] Douglas, 1937.



MAP 5. The distribution of brocades and embroideries. (A question mark indicates sites for which information is doubtful. Letters following the site numbers designate the following techniques: *B*, brocade on plain weave cloth; *E*, true embroidery (wrap-stitch or double running-stitch); *Re*, running-stitch embroidery; *Te*, twine-stitch embroidery.) (1) Grand Gulch. (2) Poncho House or Lower Chinlee Valley. (3) Navaho National Monument. (4) Kiet Siel. (5) Gourd Cave and Nitsie Canyon. (6) White House. (7) Walnut Canyon. (8) Clear Creek, Verde Valley. (9) Verde Valley Salt Mine. (10) Cave near Olberg, Pima Reservation. (11) Tonto. (12) Canyon Creek. (13) Upper Gila drainage.

completely, and in which patterns are built from blocks of different colored wefts. No one weft passes from edge to edge of the web, but each is woven back and forth over a limited number of warps.

Slit tapestry.—Slits are left at the edges of color blocks if weft threads do not interlock at points of contact but turn instead about adjacent warps. Such a tapestry is called a slit, kelim, or non-interlocking tapestry.

Interlocking tapestry.—If wefts of different colors loop around each other at points of contact so that no slits are left in the cloth, the technique is called interlocking tapestry.

Monochrome tapestry.—If wefts are passed from edge to edge of the web no design of color units is woven, and the piece is simply an exaggeratedly weft-face cloth. Sometimes such a cloth is called a monochrome tapestry.

Plain weave tapestry.—In plain weave tapestry wefts are inserted over-one, under-one warp, as for regular plain weave.

Technical Descriptions

Methods of Inserting Wefts

The following remarks on methods of inserting the wefts in tapestry weave cloth refer both to plain weave and twill tapestries (p. 551, fig. 67, C). The first shed was opened and each color of weft drawn in across the desired number of warps. The entire pick, from selvage to selvage, was filled with weftage, and threads were then battened down hard. The next shed was then opened, and each color weft carried back through

FIG. 39. Quiver from Hidden House. Length 31¾". (ASM 20491. Photo by E. B. Sayles.)

its assigned warp set. The design as a whole had to be kept in mind and each color block woven to the correct shape. Hence, the number of warps crossed by a given weft varied from pick to pick. Wefts were usually interlocked at points of contact if the edges of adjoining units were meeting along a vertical line. (An exception to this is the technique of "single warps wound" described on page 522.) If the edges of color units were meeting along an oblique line, wefts were sometimes not interlocked.

In her detailed description of Navaho tapestry weaving, Reichard emphasizes the fact that the design must be planned so that each new color of weft in a given pick is inserted in the same direction. That is, all are carried from left to right in one pick, and from right to left in the next pick, and so on.[65] This practice was not generally followed by prehistoric tapestry weavers. As our drawings show, some of the wefts in a single pick were drawn in from left to right, and some from right to left. The duplicating of prehistoric tapestry weaves—especially twill tapestries with interlocked wefts—proved an awkward task, principally because of this factor. While the heddles kept the warp sets in order, the insertion and interlocking of wefts was a slow, tedious finger process, more like sewing than loom weaving, which is essentially a mechanical technique.

Classes of Plain Weave Tapestries

Twenty-three textiles are classed as plain weave tapestry.[66] Two of these, a quiver (ASM 20491) and kilt (ASM 20493) from Hidden House, are definitely loom products; and two narrow ties, from Montezuma Castle (AMNH 14/224) and Tonto (NPS–T 9/41), may be so. The remaining nineteen pieces—narrow tump lines, cradle bands, and skirt bands—I believe were constructed in the manner of similar pre-cotton, pre-loom Basketmaker articles. However, since weave processes are basically the same whether warps were strung on a loom or held rigid by some other device, both loom-woven and non-loom plain weave tapestries are described in this section.

Loom-woven tapestries.—Two separate tapestry cloths were used in constructing the Hidden House quiver, a full description of which will be found on page 625 (figs. 39, 40, 41 and 126, A). The large rectangular cloth in the body of the quiver measures 9 inches wide by at least 16¾ inches long. The absence of one warp selvage leaves its original length in doubt. The warp selvage which remains is of a type commonly found on loom-woven fabrics (fig. 93, A). There are no extra weft selvage strings, a feature characteristic of tapestry weaves in general. Warps consist of paired white cotton threads, thirteen pairs to the inch. There are forty-seven wefts per inch. These are brown, blue, or white. The blue threads are finely spun, and have sometimes been paired to match the brown and white wefts in width. The quiver tab is a rectangular cloth 13¾ inches long by 2¼ inches wide, with warp selvages at both ends. Both cloths could have been woven either on a belt loom or an upright loom with yarn beam lowered to the desired height above the cloth beam.

[65] Reichard, 1936: 87.

[66] See Appendix C, chart 6.

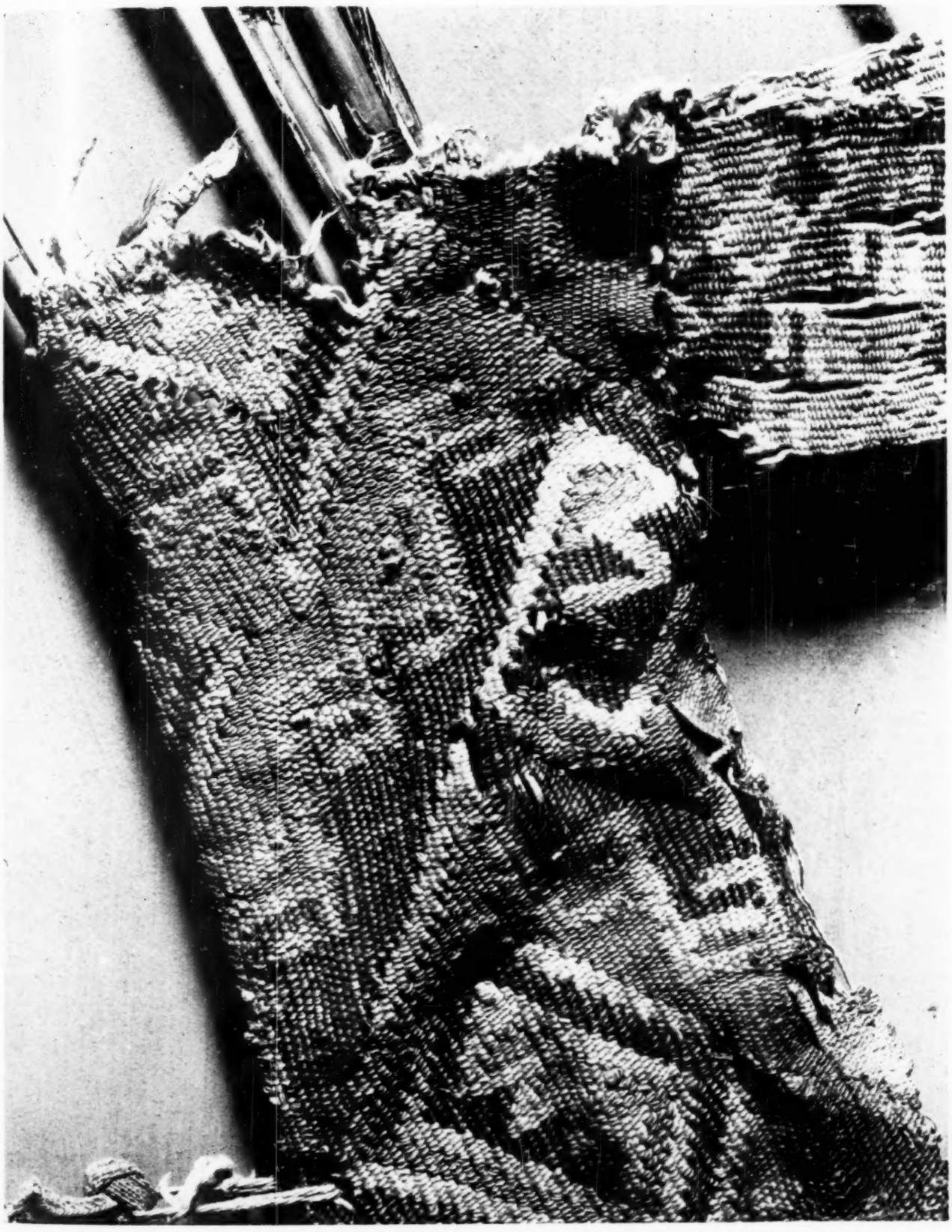


FIG. 40. Detail of tapestry weave in body of Hidden House quiver. (ASM 20491. Photo by Taylor Museum.)

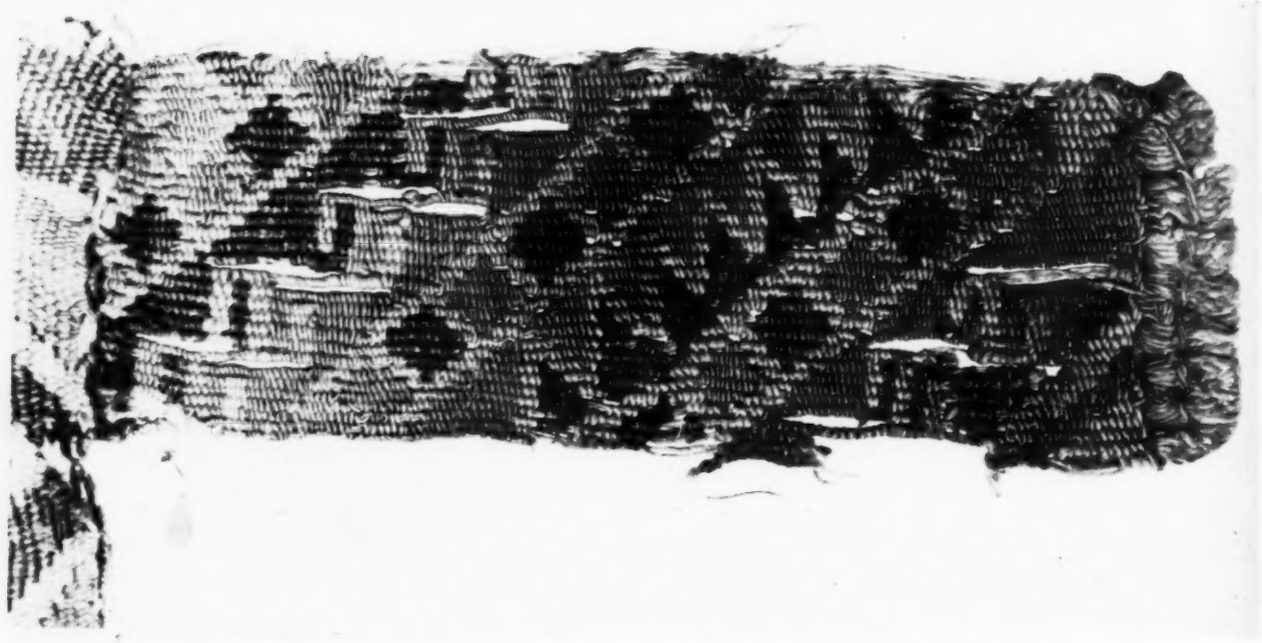


FIG. 41. Detail of fringed tab on Hidden House quiver. (ASM 20491. Photo by Taylor Museum.)

I am inclined to favor the latter process because the other Hidden House textiles, with the possible exception of very narrow warp-rep belting (pp. 529–530), seem to associate themselves with the upright loom.[67]

The pattern on the larger cloth consists of triangles or triangles with angled hooks (keys) arranged in a series along oblique lines. These lines are incorporated into broad bands, each containing a series of blue and a series of brown keys or triangles, separated by a narrow white space. The over-all pattern is not planned to fit within the borders of the cloth, but could be carried to infinity. Wefts of different colors interlock along the straight vertical backs of the keys, where there would otherwise be very long slits in the cloth. Wefts do not interlock along the oblique lines of the design, so that small slits, or holes, are left (*cf.* fig. 42, A, 4).

The design on the tab presents some differences from that on the larger cloth. Keys are smaller to fit the smaller area, triangular points are more important, and small square color blocks are used. The backs of brown and blue keys are separated by a single warp. This is wound about with white weftage which is not interlocked with adjoining colored weftage. The result —two long slits with the single wrapped warp between —is most decorative in nature. This technicality is called "single warps wound." [68] It may be clearly seen in figure 41.

Our only other example of plain weave tapestry done, beyond reasonable doubt, on a true loom is the Hidden House kilt (figs. 42, B and 43). This is a cloth 36¾ inches wide, but only 15¼ inches from warp selvage to warp selvage. All four selvages are intact. Basically a white plain weave, the cloth is decorated with narrow insets, or bars of tapestry. Each bar, a rhomboid in shape, is a few inches long, and lies oblique to the warp-weft axis. Each contains a design of opposed serrated lines, one black and one blue with a white strip between them. Blue, black, and white wefts interlock when they meet. Warps are paired in the tapestry insets, though single in the plain weave ground cloth. Wefts of the ground cloth turn back into the web at the edges of the insets, not interlocking with tapestry wefts. Because they are closely battened, there are two tapestry wefts for every one in the adjacent plain weave cloth.

Narrow tapestry bands.—The twenty-one narrow tapestries fall into five classes of articles: two narrow ties, four cradle bands, twelve tump lines, two skirt bands and a crescent-shaped object of unknown use.

Ties.—The two ties are from Montezuma Castle and Tonto.[69] Woven entirely of cotton, with single-ply white warps and colored wefts, both are slit tapestries. The Montezuma Castle piece, one inch wide, is patterned in parallel stepped lines of white, light tan, dark tan, and orange-red, running the length of the piece (fig. 44). There are only eight warps in the Tonto tie, which is three-quarters of an inch wide. White and blue-black wefts are worked into a simple design of dark points alternately to right and left of a light zigzag center line (fig. 45). These fragile bands may well have served as hair ties or garters. They could have

[67] A complete list of the Hidden House textiles is given in Appendix B, chart 1, p. 663.

[68] O'Neale, 1937: 217.

[69] AMNH 14/224, Montezuma Castle. NPS–T 9/41, Tonto.

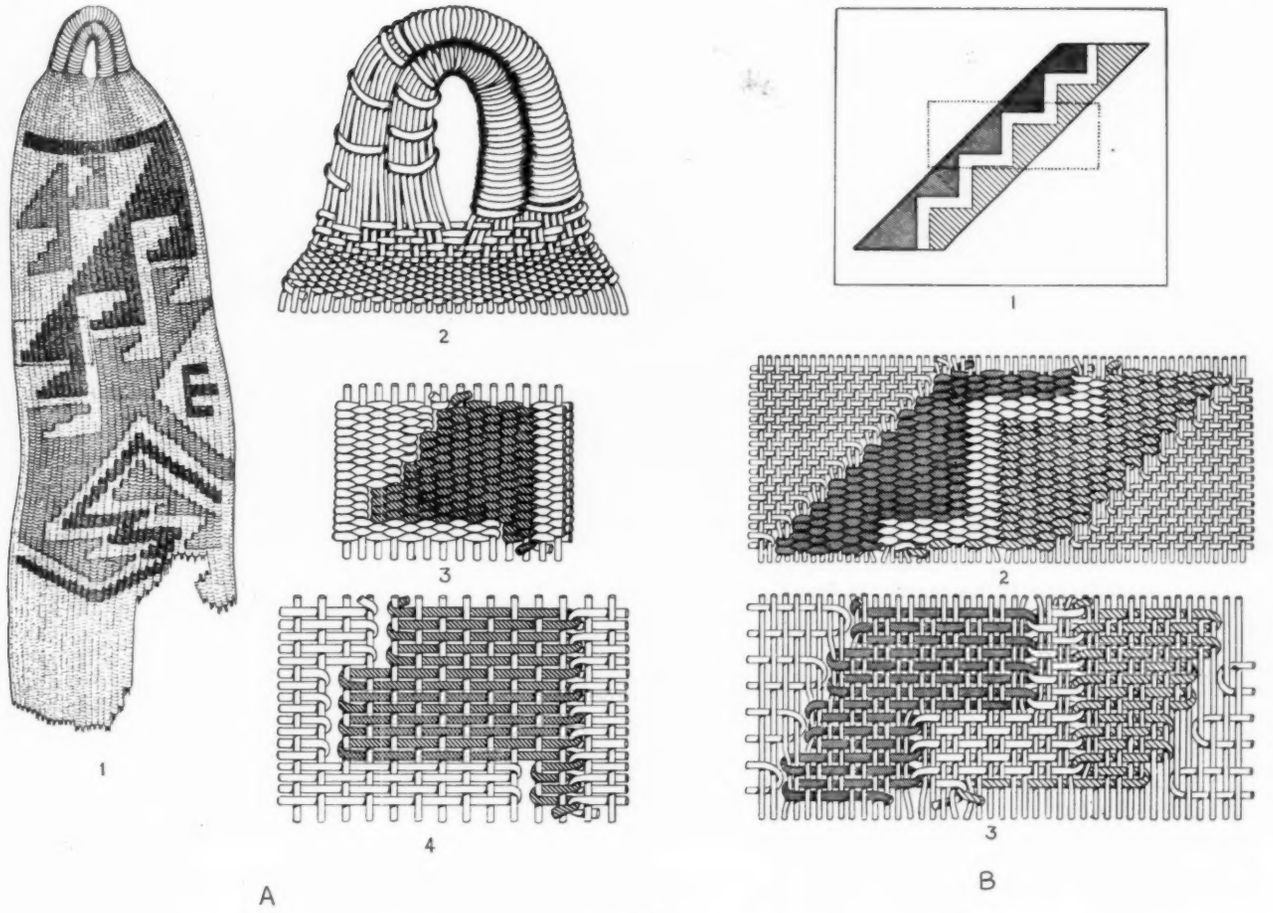


FIG. 42.

A. One end of a tump line. Wupatki. (MNA 77/NA405.M234.) (1) The pattern, woven with white, blue and yellowish-brown wefts in interlocking and slit tapestry techniques. (2) Detail of the binding of the end loop. (3) Enlargement of the weave used in the section enclosed by dotted lines in (1). (4) Detail of weave showing how wefts are interlocked up the back of a key to avoid formation of a long, vertical slit (right), and how wefts turn about adjoining warps in slit, or kelim, technique, leaving small holes up the broken edge of the key (left).

B. Tapestry inset on the plain weave kilt from Hidden House. (ASM 20493.) (1) Design of opposed serrated lines in blue and black separated by a strip of white wefts. (The obliques are not shown as terraced lines in this figure, although they are moderately stepped in the cloth itself.) (2) Enlarged drawing of the area enclosed by dotted lines in (1). (3) A further enlargement to show the interlocking of wefts within the tapestry insets, and the turning back of plain weave wefts into the web at the edges of the insets. Note that warps in the inset are used in pairs, and that there are two tapestry wefts for every one in the regular plain weave section.

been woven on a loom, or constructed after the fashion of the other narrow tapestries described below.

Cradle bands.—The term "cradle band" is applied to short (12 to 16 inches) rather wide (3 to $5\frac{3}{4}$ inches) strips of cloth, which, passed across a baby's stomach and fastened to the edges of the cradle, served to hold the infant securely in place (see p. 621). Four tapestry bands are considered to belong to this class of objects.[70] Their classification as such is fairly arbitrary and is open to argument. Three of these are so designated both because of their widths, which run $3\frac{3}{8}$ to $4\frac{3}{4}$ inches, and because they are made entirely of cotton. Heavy duty carrying bands, although they sometimes measure more than 3 inches in width, were woven with fiber warps to withstand greater strain. The fourth (PM 3196) contains fiber warps but is $5\frac{3}{4}$ inches wide, a measurement more in line with cradle bands than carrying bands.

The complete cradle band from Nitsie Canyon (ASM 2775) indicates the method used in weaving these articles. Warps were stretched between two small sticks which projected slightly beyond the proposed edges of the web. These sticks ultimately served as toggles by which the completed band was fastened to the side bars of the cradle. Both sticks remain on the Nitsie piece,

[70] ASM 2775, A small ruin near Inscription House, Nitsie Canyon. ASM 3446, Gourd Cave. PM 3196, Source unknown. USNM 156276, Palatki.

FIG. 43. Kilt with tapestry weave insets. Hidden House. 36¾″ by 15¼″. (ASM 20493. Photo by E. B. Sayles.)

and there are traces of hide strips which were fastened about them over the warp loops to prevent excessive wear on the cotton threads (fig. 46). During weaving the sticks must have been fastened to other supports so that warps were held taut. The warps of this band are paired two-ply natural color cotton threads, wefts are brown, yellow, or white, also two-ply. Both slit and interlocking techniques were used. Wefts were drawn in according to the Navaho method mentioned on page 520, all passing from left to right in one pick and from right to left in the next.

The piece was found, according to the Arizona State Museum catalogue, on the trash mound of a small ruin near Inscription House. The catalogue remarks on the similiarity of design to that of the "early Cave people." The arrangement of the pattern in three separate segments with a repeat of virtually the same design in each segment is certainly reminiscent of pattern distribution on Basketmaker fiber tump lines, sandals, and women's aprons (figs. 47, A and 49). So also is the use of simple triangular points along oblique lines with the absence of the complex interlocking of design units so typical of Pueblo III–IV textile patterns. The piece is labeled "Anasazi 500–700" in the Museum exhibit. It is unfortunate that we have no more exact information on the circumstances of the find, since it makes a strong bid as evidence of the presence of cotton in pre-Pueblo horizons in northern Arizona.[71]

An all-cotton slit tapestry band from Palatki (USNM 156276), also complete, is slightly more than 16 inches long.[72] Judging from the ends of the piece, two-ply warps were stretched between small sticks, as for the Nitsie Canyon band. There is no interlocking of wefts, even though some of the slits are three-fourths of an inch long. There is no trace of color, but it is probable that the slits did separate color areas, as in other tapestries. A theoretical reconstruction of the pattern in three colors, based on the distribution of slits, is shown in figure 47, C.

There is nothing remarkable about the Gourd Cave cradle band (ASM 3446). Incomplete in length, it is a slit-tapestry woven of two-ply cotton threads throughout. Colors, probably three in number, have faded beyond recognition.

The cradle band with fiber warps (PM 3196) is a slit tapestry, wherein soft, thick cotton wefts create a simple negative pattern of narrow white lines on a brown field (fig. 47, B). The source of the piece is not known. The design so closely resembles those on a brown and white diamond twill fragment from northern Arizona (fig. 66) and the brown and white breech cloth from White House (figs. 79, 80), that one is tempted to believe all three pieces were woven in the same village.

Carrying bands.—The majority of narrow tapestry weaves, twelve in number, are probably carrying bands or tump lines.[73] Passed about the forehead, and with

[71] Samples of warp and weft threads from this band were submitted to F. Martin Brown (April, 1954), who verified my identification of them as cotton, with no trace of any other fiber material.

[72] Hough, 1914: 80–81.

[73] See Appendix C, chart 6: AMNH 29.0/9975, Aztec Monument. AMNH 29.1/7993, White House. MNA 77/NA405.M234, Wupatki. MNA 695/NA2519.466 and 695/NA2519.714, Kiet Siel. MNA 1032/NA1629.117, Kinnikinnick. NPS-MC 12, Montezuma Castle. NPS-T no number, Tonto Monument. PM A5058, Middle Tsegi. UM 29.27.37, Forbidden (For-

the ends fastened to a load on the back, the tump line served to help in transporting heavy burdens. These bands had to be sturdily woven to withstand the strains to which they were subjected. Eleven were constructed of two-ply fiber (yucca?) warps in combination with closely battened cotton wefts. Two of these, from Aztec (AMNH 29.0/9975) and Kiet Siel (MNA 695/NA2519.714) are plain monochrome tapestry throughout, natural color wefts running from side to side of the web with no attempt at weaving a pattern. The Kiet Siel line was covered with a dark substance, possibly pitch applied to make the band more durable by preventing wear on the threads. The other nine fiber-and-cotton bands are slit or interlocking tapestries, featuring two or three weft colors.

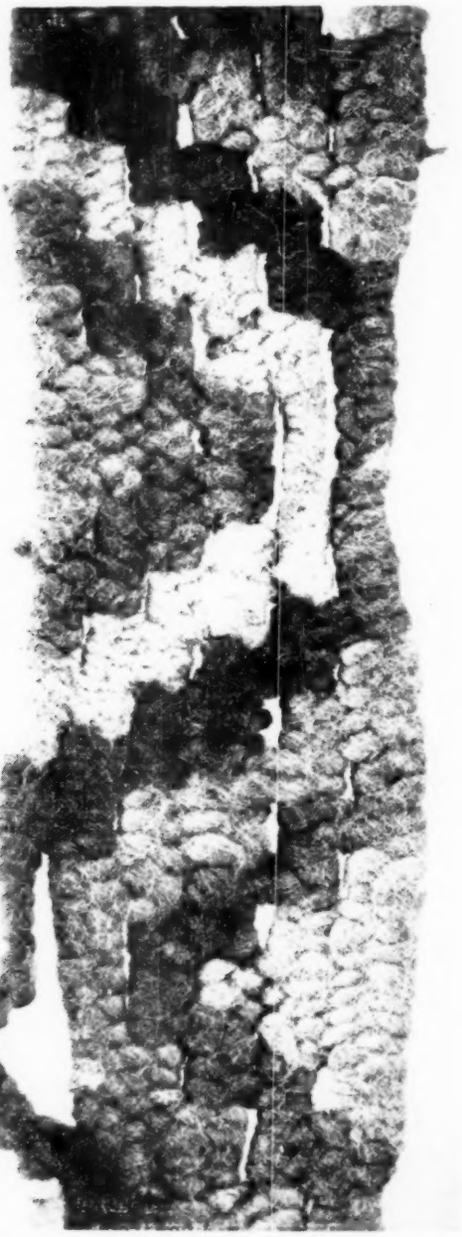


FIG. 44. Slit tapestry cotton tie with white, orange-red, light and dark tan wefts. Width 1". Montezuma Castle. (AMNH 14/224. Photo by E. B. Sayles.)

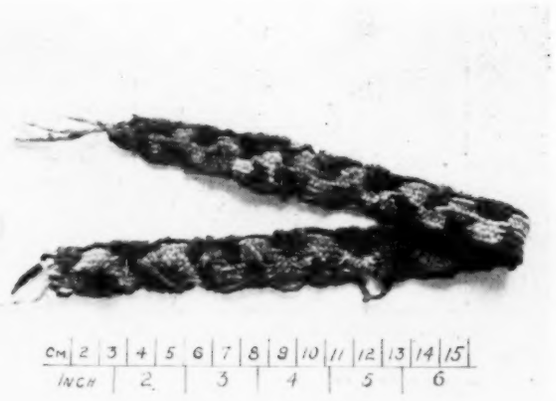


FIG. 45. Slit tapestry cotton tie with white and blue-black wefts. Width ¾". Tonto Monument. (NPS–T 9/41. Photo by National Park Service.)

The nature of the loops at the ends of several tump lines is good evidence of the manner in which these articles were constructed. That from Wupatki (MNA 77/NA405.M234), illustrated in figure 42, A, 2, will serve as a typical example. A continuous yucca string was wound between two supports spaced the distance of the desired length of the band. These may have been simply two pegs set upright in the ground. The string, in this case, was looped seventeen times about each end support, so as to make a total of thirty-four warp threads. Starting at one end the weaver separated the yucca strings into two groups, binding these tightly with a cotton thread. Having formed a sturdy loop in this fashion, he wove the thread over and under groups of warps from edge to edge of the proposed band, gradually separating these bunched warps until the weft was moving over-one under-one. A small section of monochrome tapestry was woven, after which the decorative area was commenced. At the other end support a bound loop similar to that described, was made, either before or after the band was woven.

The Pueblo I carrying band from the Tsegi (PM A5058) is unique with regard to warp material. Incomplete in length, the band now measures 16 by 2¼ inches. One end loop remains. Wefts are two-ply S-twist cotton threads, white and yellowish-brown in color and numbering about fifty to the inch. There are twenty warp elements in all. Half of these are two-ply black cotton threads used in groups of three; the other half are two-ply brown hair or wool, grouped also in threes. (In other words, a total of sixty threads enter into the warp set-up, thirty wool and thirty cotton, but these are handled in units of three, so that for all

bidding?) Canyon. Cummings, 1915, source unknown. Pepper, 1920, Pueblo Bonito.

FIG. 46. Slit and interlocking tapestry weave cradle band with brown, white, and yellowish wefts. Length, 13⅜". Nitsie Canyon. (ASM 2775. Photo by E. B. Sayles.)

practical purposes there are ten wool and ten cotton warps, or twenty in all.) The pattern is of zigzag vertical lines four warps wide, alternately white and colored.[74]

A tump line pictured by Cummings is assigned only to northern Arizona and not dated.[75] A sketch of the design on this piece shows that it is very like that painted on a Vandal Cave Basketmaker III all-fiber tapestry weave tump line. It may be that the two are from the same period (fig. 47, A). If so, and *if* the wefts are cotton, as they are said to be, this would be an instance of the use of that fiber in Anasazi territory before 700.

Skirt bands.—Women's skirts, or aprons, are discussed on pp. 613–616. The waist bands of two of these are regular slit and interlocking tapestry weaves. They were evidently woven after the manner of narrow tump lines, with warps strung between two supports. Separate threads were looped along one edge to make the apron fringe. Two-ply cotton threads were used for the warps and wefts of both bands. One (ASM 25982, Northern Arizona) contains ten warps, each being a bundle of three threads. Brown and white wefts are woven over these in slit tapestry technique (figs. 118, D; 119). The second (MNA 695/NA-2519.759, Kiet Siel) is a band 1¼ inches wide, with white and tan cotton wefts woven in slit and interlocking techniques. There are thirteen warps and fifty wefts to the inch (fig. 117).

Crescent-shaped article.—A visor-like object from northern Arizona (ASM 23492) remains an enigma as to use and method of manufacture (fig. 48). It contains twenty two-ply fiber (yucca?) warps, and two-ply white cotton wefts. The warps were strung continuously, as for a tump line, and there are two end loops. It is eight inches between the tips of these loops. The warps, however, were not laid up in a straight line between loops. Those at the outer edge of the "visor," or crescent, are considerably longer than those near the inner edge. The warps were bunched into two groups at the loops, and separated gradually towards the maximum width of the piece (2½ inches) at the center of the crescent. The University Museum collections from Southwestern Colorado include similar crescents of yucca thread stitched with cotton.

Short lengths of cotton thread looped through the cloth may have fastened some sort of decorative objects to its surface, or this may have been a woman's apron with a cotton string fringe.

The Distribution and History of Plain Weave Tapestry

The twenty-three examples of plain weave tapestry come from fourteen known and four unrecorded sites. Twelve of these are probably Anasazi, five Sinagua, and one Salado. Two of the Anasazi pieces are very early—one from the Pueblo I grave in the Tsegi (PM A5058) and one (ASM 2775) from Nitsie Canyon. The latter piece may even be of Basketmaker III manufacture. A third tump line from an unnamed site in northern Arizona (Cummings, 1915: 6) may also date to Basketmaker III. The other Anasazi tapestries are probably all Pueblo III, as are the Sinagua pieces from Wupatki and Hidden House. Other Sinagua and Salado examples—from Kinnikinnick,

[74] See Guernsey, 1931: 97–98 and pl. 10*h*. His description differs in some details from mine. He gives measurements as 15 inches long by 12½ inches wide. Obviously the latter figure was intended to be 2½ inches. He lists weft colors as white, reddish-brown, and red shading on yellow. I noted only white and yellowish-brown. This discrepancy may be caused by fading of colored threads since the piece was unearthed. He counted twenty-two warp units, while I counted twenty, and he does not mention that these consisted of groups of three threads and of two classes of material.

[75] Cummings, 1915: 6.

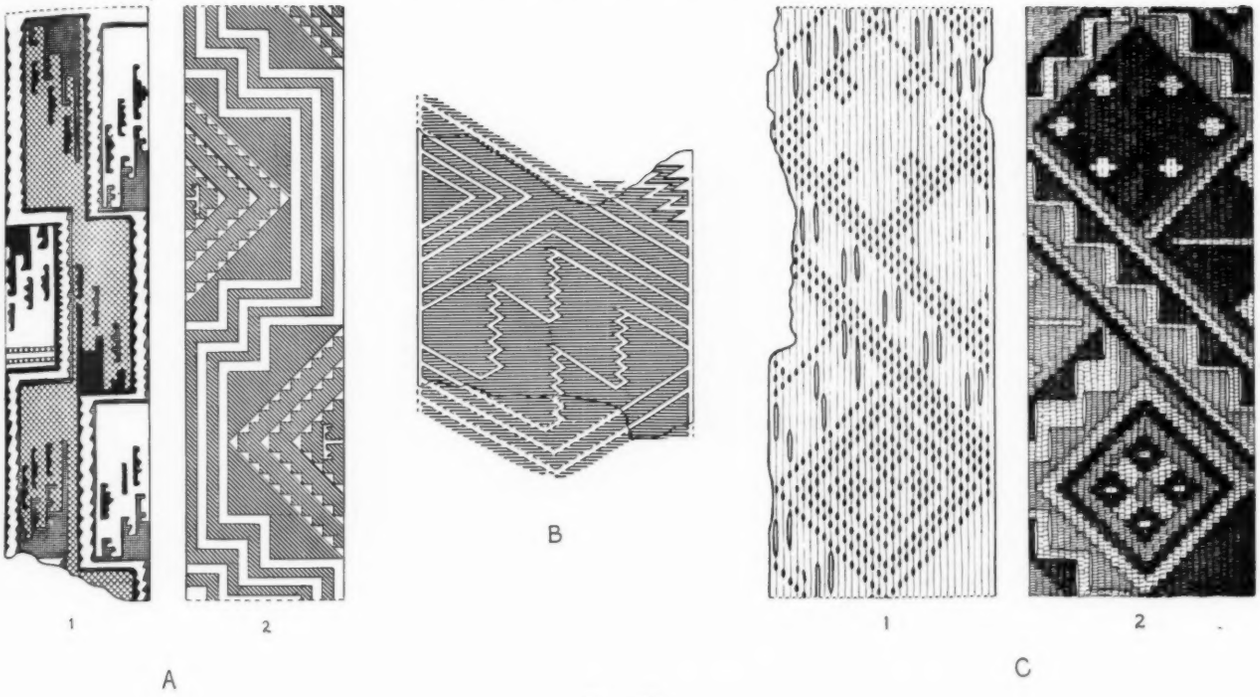


FIG. 47.

A. Designs on early tump lines. (1) Basketmaker III plain weave tapestry tump line from Vandal Cave. Yucca warps, apocynum wefts. Design painted on one surface in three colors: pink (small check), shiny black (solid black), and yellow (diagonal cross-hatching). (ASM 15996.) (2) Tump line of unknown date from "Northern Arizona," said to have a yucca warp and cotton weft fill. Note the similarity of these pieces in design distribution, and in the use of serrated lines and the large T-shaped element. These features indicate a possible Basketmaker source for the tump line with the cotton wefts. (After Cummings, 1915: 6.)
B. Brown and white design on a slit tapestry from Northern Arizona. Width, 5¾". (PM 3196.)
C. Slit tapestry band from Palatki. Width, 4½". (USNM 156276.) (1) The pattern of long and short slits. At present wefts show no variation in color, but it is thought they were once dyed. (2) A theoretical reconstruction of the design in three colors.

Montezuma Castle, Palatki, and Tonto—are Pueblo IV. There is no evidence for the use of cotton in tapestry weaving among the Hohokam, although their knowledge of the technique is indicated by the finding of an all-fiber slit tapestry fragment from Ventana Cave.[76]

It seems apparent that plain weave tapestry was a recognized finger-weave technique for the manufacture of tump lines, skirt bands, and certain other articles, from at least Basketmaker III through Pueblo IV times among the Anasazi and perhaps in the Southwest as a whole. Narrow bands were generally constructed on a skein of warps looped between two supports. Anasazi-Basketmaker bands were generally monochrome tapestries decorated with painted designs, but some tump lines and women's aprons were woven in slit and interlocking tapestry techniques (fig. 49). Basketmaker tump lines had yucca fiber warps and yucca fiber or, more commonly, soft apocynum (?) wefts. In late Basketmaker III or early Pueblo I, cotton began to be substituted for the apocynum wefts. It was occasionally used as warp material in cradle and skirt bands, wherein it would not be subjected to much strain. By Pueblo III painted designs were entirely supplanted by those woven in with colored weft threads.

[76] Haury *et al.*, 1950: 457–458.

There is no reason to believe that, among the Anasazi, after the introduction of cotton, the process of making plain weave tapestries changed from one of simple finger-weaving on a frame with no heddles to loom weaving. The technique was used to some extent in loom weaving in central and southern Arizona in Pueblo III and IV, as indicated by the Hidden House quiver and kilt and (with *much* less certainty) by the narrow cotton ties from Montezuma Castle and Tonto. Even south of the Rim, however, tapestry weave tump lines were constructed on a warp skein foundation as late as Pueblo IV. It is possible that among the Anasazi the manufacture of tump lines, skirts, and cradle bands was women's work, and the technique of plain weave tapestry was never transferred to true loom weaving by the men.

Throughout the Southwest in Pueblo III and IV tapestry weave came into its own as a loom technique only in connection with *twilled* cloths. In them the qualities we have been describing appear—the closely battened interlocking wefts, and the building of designs from small color blocks. Many twill tapestries take the form of narrow articles, but they are marked as loom products by typical selvages, single-ply warps, and twill rhythms implying the use of heddles.

FIG. 48. Plain tapestry weave crescent-shaped object. Yucca warp and cotton wefts. Length between loops, 8". Probably from northern Arizona. (ASM 23492. Photo by E. B. Sayles.)

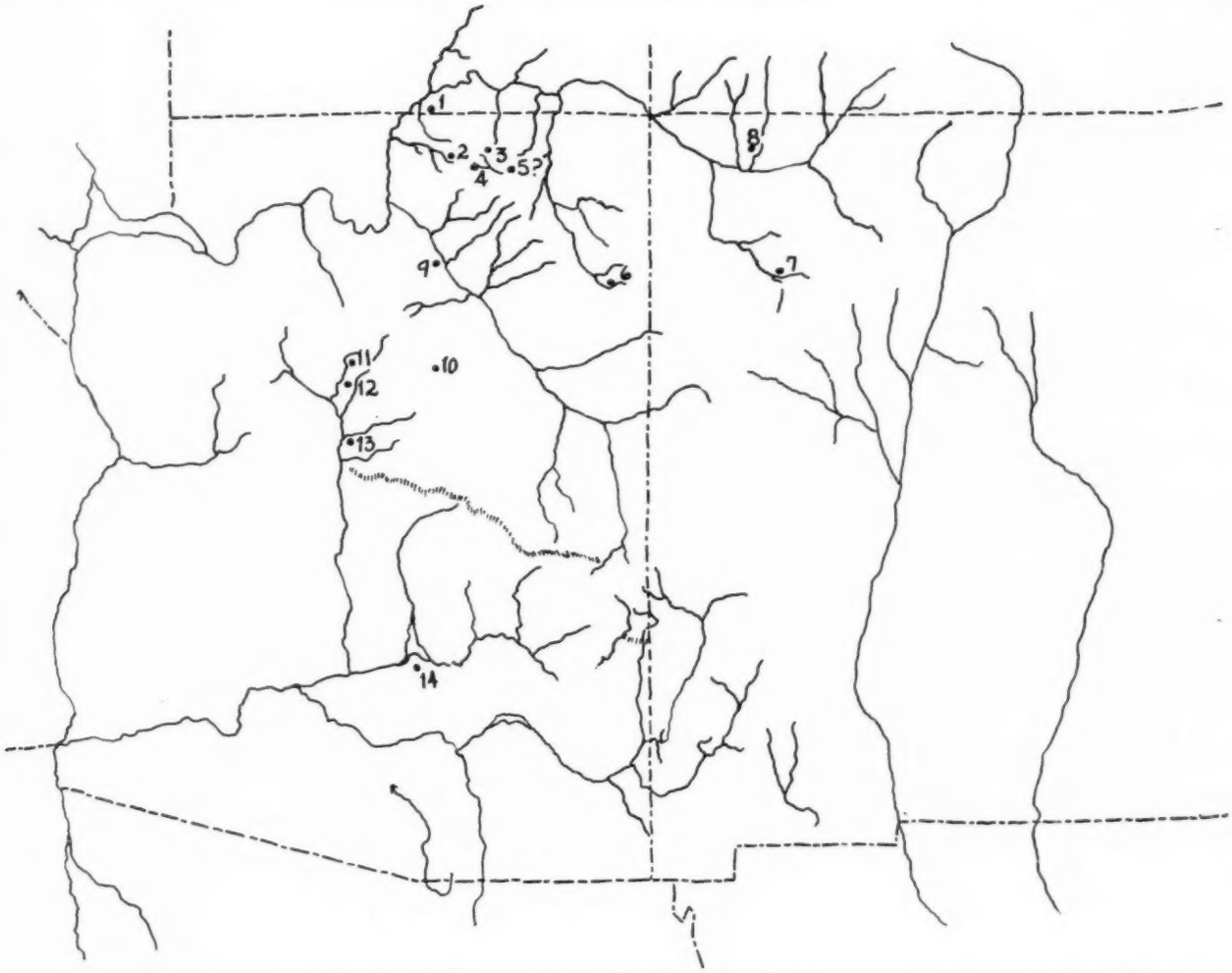
At the present time no narrow tapestry bands are woven in the Southwest. Most of the wool rugs and blankets made by the Pueblo Indians for tourist sale are plain weave weft-face cloth, or monochrome tapestry, with each weft running the full width of the web. Both interlocking and non-interlocking plain weave tapestries are common among the Navaho, and woven to some extent by the Pueblos, but bear little resemblance to prehistoric Pueblo tapestries. The ancient idea of building an over-all repeat pattern of tiny color blocks has given way among the Pueblos to the weaving of weft stripes. Navaho tapestry patterns, rather large and bold, are quite different in character from prehistoric design. It is interesting to note that traditional Pueblo wide-loom fabrics, such as the wedding robe, woman's dress, and man's shoulder blanket, are not tapestry weave, but simply plain or twill weave cloth, more or less weft-face, as in pre-Spanish times. The weaving of plain tapestries on the large upright loom is probably a recent development.

Tapestry weave, as we have seen, requires that the warps be held rigid between two supports while the wefts are woven in and battened as close as possible. This is like loom weaving, but it is improbable that the true loom with heddles developed in connection with tapestry weave in either the New or Old Worlds. Design units were usually small, so that the weaver handled very few warps at a time, working the weft back and fourth across them almost as in darning. The need for a mechanical aid to lift a whole series of warps would not make itself felt. In Peru, as in the Southwest, the earliest examples of tapestry weave took the form of narrow ribbons, headbands, and belts. An important development of the technique on wide cloths came about later in the time scale, when some elaborately patterned fabrics came to be so woven on the regular two-bar loom.[77] In the Old World, tapestry weave seems to have developed independently of the two-bar and heddle loom, also, although it was later adapted to loom weaving. One authority describes early Asiatic tapestries as woven on: "A light, square frame like an embroidery frame." [78]

In summary, I would suggest that the manufacture of narrow tapestry bands was a widespread pre-loom, pre-cotton art in the New World. After the development (or introduction) of the loom in Peru, the art was adapted to loom weaving there. In this form it spread north with cotton and certain weave techniques.

[77] O'Neale, 1942: 154.

[78] Schuyler Cammann, personal correspondence, May 7, 1948.



MAP 6. The distribution of plain weave tapestries. (A question mark indicates doubtful provenience.) (1) Forbidden (Forbidding?) Canyon. (2) Gourd Cave and Nitsie Canyon. (3) Kiet Siel. (4) Tsegi Canyon, Cave #1, Middle Branch, Grave 1, Burial 2. (5) Northern Arizona. (6) White House. (7) Pueblo Bonito. (8) Aztec. (9) Wupatki. (10) Kinnikinnick. (11) Hidden House. (12) Palatki. (13) Montezuma Castle. (14) Tonto.

It may have been practiced in Central America and Mexico, but does not seem to have found great favor (except in the form of twill weave) in the Southwest in pre-Spanish times. There is no evidence that the Anasazi ever wove wide loom plain weave tapestries, and we have only two (or *possibly* four) loom-woven plain weave tapestry articles from Sinagua and Salado sites.

PLAIN WEAVE, WARP-FACE BANDS AND WARP-FLOAT PATTERN WEAVES

1. *Warp-Face Bands*

Definition

A warp-face plain weave cloth is one in which the number of warps greatly exceeds the number of wefts per inch, sometimes to the point of obscuring the wefts completely. If warps alone show, the cloth is sometimes called "rep."

Technical Description

All wide plain weave fabrics, with the exception of pieces from Ventana Cave, tend to be weft-face in appearance. Warp-face plain weave is represented by narrow cotton bands and ties, and these are few in number [79] (figs. 51, B; 52, A).

There are fifteen tie or belt fragments between one-half and two inches wide. Woven from single-ply cotton, sample thread counts for these are:

Hidden House (ASM 20485)	34 warps, 17 wefts
Verde Valley (AMNH 14/216)	62 warps, 43 wefts
Tonto Monument (NPS-T R-1)	52 warps, 10 wefts

In some cases, selvage threads twist along the weft edges of a tie after the manner described for wide loom fabrics (p. 485). In other cases wefts simply turn about the edge warps and re-enter the weave. Eleven

[79] See Appendix C, chart 7, *a*.

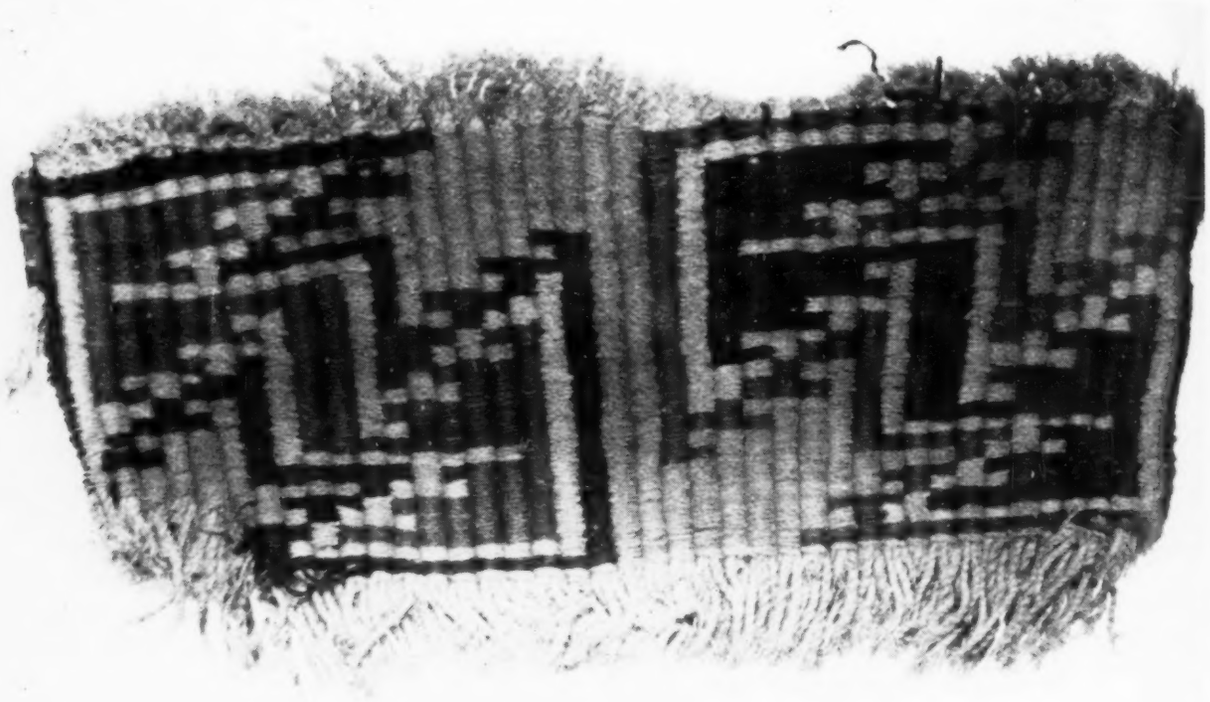


FIG. 49. Interlocking tapestry weave center pad of a Basketmaker woman's apron. Yucca (?) fiber. Wefts are black, dark brown, and natural tan. Width $5\frac{3}{8}$". Slabhouse Ruin, Duggagei Canyon. (ASM 3128. Photo by E. B. Sayles.)

ties are woven from natural white thread, one is dyed black (MNA 693/405S4.91, Wupatki), one contains brown and white warps and brown wefts (ASM 13389, Cottonwood), and two (possibly parts of one belt) have black and white warps and white wefts (ASM 20498 and 20499, Hidden House).

Patterns of broken vertical stripes appear on ties having colored warps. These patterns depend entirely upon the way in which the dark and light warps were grouped during the stringing of the loom. Belting from Hidden House, illustrated in figure 53, B, contains forty warps, twenty-four white, and sixteen black, strung in the following sequence:

6w-b-w-b-w-*4b*-w-b-w-b-*4w*-b-w-b-w-*4b*-w-b-w-b-*6w*

In regular over-under plain weave, the first weft pick was passed from left to right beneath: 3w-4b-4w-4b-5w, which were controlled, say, by the heddle. The second weft pick was inserted from right to left beneath: 3w-4b-4w-4b-5w, controlled by the shed rod. These steps were repeated the length of the tie. Since the weft functioned merely as a filler, hardly showing on the surface of the cloth, the pattern made was of two vertical black stripes with small black color blocks offset up their edges. This simple design is found on Basketmaker twined-woven bags, wherein the wefts are the pattern element,[80] and on Basketmaker twined-warp ties.[81] A somewhat more complex design is produced on the brown and white belting from Cottonwood (ASM 13389) by the planned grouping of forty white and forty-two brown warps (fig. 53, A).

There is some doubt as to the exact loom rig (or rigs) used in weaving these ties. It is probable, however, that they were woven on the belt loom. None of the examples is complete in length, but that they may have been up to 10 or 12 feet long is indicated by the two fragments from Hidden House. One of these measures $64\frac{1}{2}$ inches and the other $77\frac{3}{4}$ inches. If they are parts of one belt, as seems likely, this would have been at least $142\frac{1}{4}$ inches long. In making such an article the weaver would keep the unused lengths of warp wound about the yarn beam, and would roll up completed belting on the cloth beam so as to keep the work area within easy reach.

Slightly different in weave and appearance from the ties just described, but structurally a warp-face cloth, is the cotton fragment $1\frac{3}{4}$ inches wide from Gourd Cave (ASM 3018). The warps of this piece are soft, thick two-ply brown or white string, the wefts two-ply white string more tightly twisted. Brown and white warps are handled in pairs, a pair of brown alternating with a pair of white. Wefts regularly pass over the white pairs in one pick, the brown in the next, and repeat. The piece should properly be called a warp-face half-basket weave (p. 496; figs. 52, B; 53, C). It could

[80] Guernsey and Kidder, 1921: 74, pl. 29, *c* & *f*.

[81] Kidder and Guernsey, 1919: 173, fig. 82.

either have been woven on a loom, or constructed after the manner of some tump lines, with warps wound between two supports and wefts inserted without the aid of heddles (p. 525).

2. *Warp-Float Pattern Weaves*

Definitions

Warp-float pattern weave.—In warp-float pattern weave a design is built up by warp floats on the surface of the cloth. A warp-float fabric is usually warp-face.

Float.—"A thread that runs free for a distance either on the face or on the back of the fabric, since it is, for a space, not interwoven with any of the other threads." [82]

Technical Descriptions

Warp-float with two sets of warps.—A form of pattern weave which I call "warp-float with two sets of warps" was used in making a narrow cotton tie or belt from Tonto (NPS–T 9/542). This is a crudely executed piece almost an inch wide. There are fifty-six single-ply warps in all, and the two-ply wefts number twelve per inch. Warps are divided into an upper, or surface, set and an under, or lower, set. The upper set consists of twenty-eight warps, or every other one, which normally interweave with wefts to produce a plain weave cloth, while the remaining twenty-eight, or the lower set, float on the undersurface of the web. The pattern is made by bringing forward certain of the under warps and floating them on the surface of the cloth for a number of weft picks. When this is done, neighboring warps of the upper set are forced back, and float on the underside of the web.

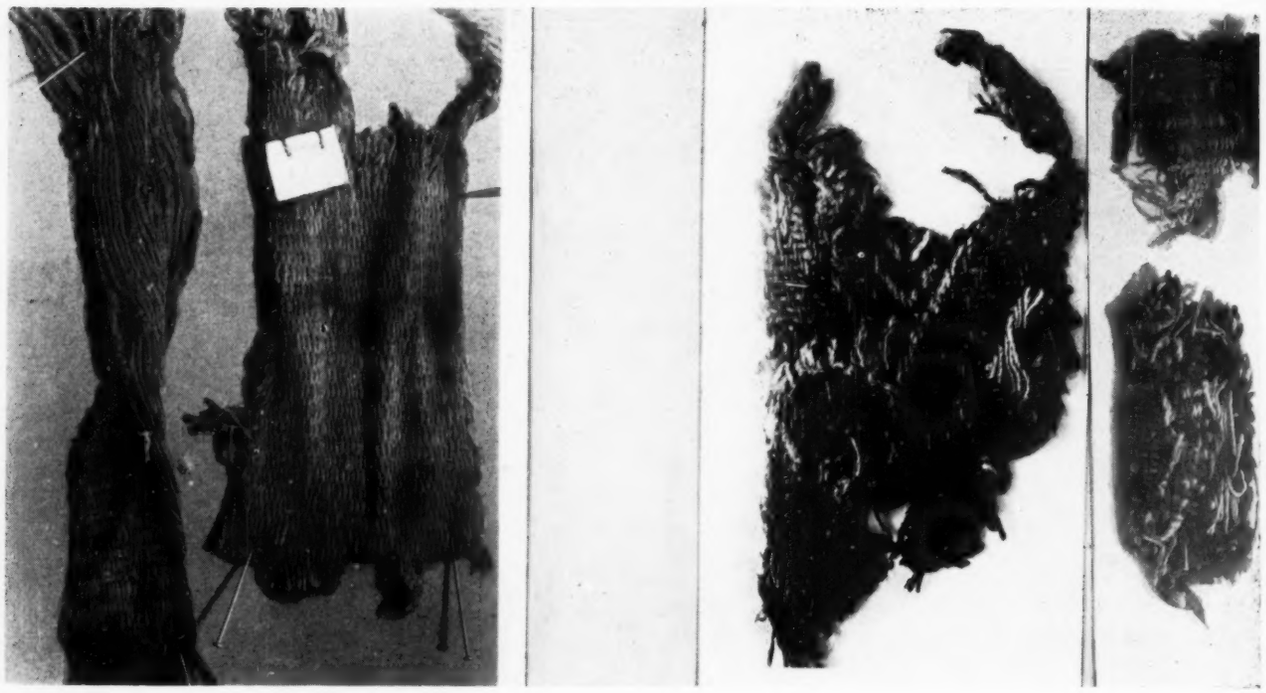
The under set of warps in such a weave is usually a different color from the upper set, so that the floated warps make colored figures on the surface of the cloth. The pattern possibilities are almost unlimited. There is no evidence that any of the warps in the Tonto piece were dyed. The design, virtually indistinguishable in so small a fragment, depends on the contrast between the "checker" effect of plain weave areas and the long, vertical lines of warp floats (figs. 51, A; 53, E).

The weave was duplicated in the laboratory on a loom rigged as for regular plain weave. All warps governed by the heddle were considered members of the surface, or upper, set. A small retaining stick was inserted behind them to hold them forward. Plain weave was easily executed on this set, the batten being run through over and under alternate warps for each weft pick. When a float was wanted, a warp from the under set was selected with the fingers, brought to the surface, and placed over the retaining rod, replacing an adjacent warp of the upper set, which was forced back beneath the retaining rod. Thus the under warp—or warps, if more than one were brought forward—became for a time part of the surface set. These warps were not included in the plain weave, however, but were allowed to float free—the weft being always passed behind them. Had they been a different color from the surface set, it would have been easy to remember to float them. As it was, I experienced some difficulty in keeping them distinct from the regular upper warps. Even so, it was not difficult to achieve a pleasing self-pattern on the face of the cloth.

FIG. 50. Slit tapestry fragment from Montezuma Castle. Yucca warps. White, yellow, and black cotton wefts. Width, 3¾". (NPS–MC 12. Photo by Denver Art Museum.)

Warp-float pattern weave (or warp-face twill).—Four small scraps tentatively identified as warp-float pattern weave come also from Tonto (NPS–T 9/207; figs. 51, C, D; 53, F). The pieces are in very poor condition, so that accurate analysis is difficult. Warps are alternately single-ply brown and two-ply white threads. Wefts are thick, single-ply brown threads. Brown

[82] Reath, 1927: 7.



A B C D

FIG. 51. A. Warp-float ribbon about 1" wide. Tonto Monument. (NPS–T 9/542.) B. Plain weave warp-face ribbon. Tonto Monument. (NPS–T R-1.) C. Brown and white warp-float. Tonto Monument. (NPS–T 9/207.) D. Two additional views of C. Top photo shows plain weave "border" to which brown and white warps are joined. Bottom photo shows reverse side of fabric. (Photos A and B, K. Bartlett; C and D, National Park Service.)

warps normally float in echelon over-two under-two wefts, to make a diamond twill effect. White warps are brought to the surface at certain points—perhaps to emphasize completed diamonds. It is impossible to say whether heddles were used in weaving this piece. If they were, and a regular rhythm of floating warps thus established, the weave should be called a warp-face *twill* rather than a *warp-float*. In my opinion warps were not governed by heddles, but were selected by hand for each pick of weft.

The full width of the cloth cannot be determined. Enough remains at the end of one scrap to show brown and white warps passing in pairs through the warp loops at the edge of a plain weave white cloth woven from coarse, two-ply threads. Warps for both plain weave and design portions could have been strung on the loom before weaving commenced, interlocking of threads being carried out over a temporary loom bar. There is no hint of the original length of the plain weave section. The pieces could have been a breech cloth with warp-float pattern weave front, or a white sash with patterned ends. It is equally possible that the plain weave took the form of a narrow border on a warp-float cloth. The same type of coarse plain weave was found attached to the warp edges of a brocaded weft-float breech cloth from White House (pp. 560, 613).

A second explanation for the joining of plain and floated weaves in this cloth is that the paired brown and white threads are actually *wefts,* interlocking with the *wefts* of a plain weave section. This means the loom would have been strung with a band of two-ply white warps and a band of single-ply brown warps. This possibility was ruled out because of the character of the brown threads which would then, theoretically, be the warps. These are very soft and thick, and it hardly seems likely that they could have been subjected to the tension usually placed on warp threads. If the piece had been woven in this manner, it would be either a brocaded twill or a brocaded weft-float like the White House breech cloth. (Note that the plain weave section would be adjacent to the *weft* edge in this case, whereas plain weave is attached to the *warp* edge of the White House cloth.)

The Uses of Warp-face and Warp-float Pattern Weaves

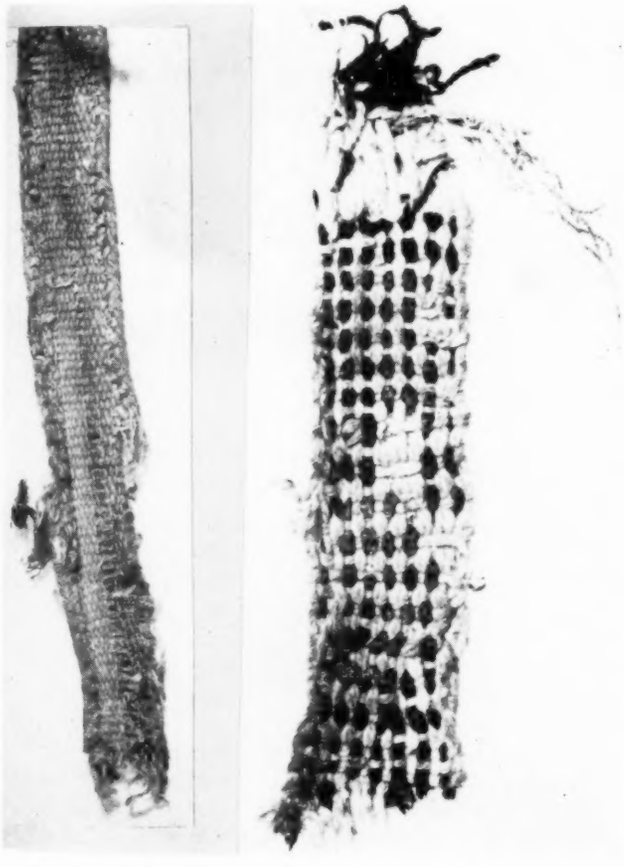
Fifteen of the warp-face cloths, and the all white warp-float pattern weave, are narrow ties or ribbons between a half and two inches wide. Four of these were definitely used as the belts for breech cloths, and two as ties on mummy wrappings of infants. One served as the carrying strap of the large Hidden House quiver (fig. 39) and another was wrapped about an agave stalk "medicine box" from the same site. The others may have had similar uses, or have served as garters or hair ties. The heavy piece from Gourd Cave

may have been belting, or a cradle band (p. 521), and the brown and white warp-float from Tonto possibly a sash, or breech cloth front.

The Distribution and History of Warp-face and Warp-float Pattern Weaves

Distribution

The eighteen examples of warp-face and warp-float cloth come from eight sites: the Pueblo III and IV Sinagua villages of Walnut Canyon, Hidden House, Wupatki, and Montezuma Castle, and two unnamed sites of the same culture in the Verde Valley; the Salado town of Tonto; and Ventana Cave. All over the Southwest between 1100 and 1400 cotton ties generally took the form of flat braids (pp. 593–595). Among the Anasazi these were apparently not supplemented by warp-face bands as they were among the Sinagua, Salado and Hohokam. (The Gourd Cave piece is not a typical warp-face tie, being woven of coarse, heavy threads and paired warps.)



A B

FIG. 52. A. Narrow plain weave warp-face tie. Width, $\frac{9}{16}$". Ventana Cave. (ASM–A 4752.) B. Plain weave warp-face tie with two-ply brown and white warps. Width, $1\frac{3}{4}$". Gourd Cave. (ASM 3018.) (Photos by E. B. Sayles.)

Warp-face fiber or hair bands

Narrow plain weave warp-face bands of fiber or human hair are reported from Basketmaker II and III sites in the Kayenta area and from Doolittle Cave on the Mimbres.[83] These were made by looping a skein of warp threads about two supports and inserting the weft as a filler. Warp loops at the ends of the straps were sometimes left free and sometimes bound with string. (Compare this with the end loops of plain tapestry weave carrying bands, p. 525.) In one of the Kayenta examples human hair and fiber warps were alternated so as to produce a simple pattern. There are three warp-face fiber burden straps, called "Cliff-dweller from Southwestern Colorado," in the University Museum collections.[84] Equipped with end loops, these were woven like the Basketmaker bands. An inch-wide warp-rep ribbon of apocynum fiber, probably dating to Basketmaker II, was included among the Chihuahua textiles studied by O'Neale.[85] This has paired wefts, and no extra selvage cords. O'Neale considered it too fragile to be anything but an item of wearing apparel. The method by which it was woven is unknown. Narrow apocynum fiber bands with "three-ply selvages" were among the seventeenth-century textiles from Awatovi.[86] The presence of selvage threads indicates that these were probably loom products.

The Spread of Warp-face and Warp-float Weaves as Loom Techniques

The relationship of all these warp-face *fiber* bands to those of cotton must be explored. In the Anasazi area warp-face carrying straps were apparently fashioned from skeins of fiber thread from Basketmaker II through Pueblo III times. Cotton thread does not appear to have been handled in this way as a rule, although the Gourd Cave half-basket weave may be an exception. The weaving of warp-face bands was not undertaken as a loom technique. Possibly, as suggested on page 527 the manufacture of burden straps was by tradition a woman's task, while loom weaving was a man's activity, so that the transfer of warp-face plain weave from a finger to a loom process simply did not occur. In Pueblo IV times influences from the south changed the picture. Warp-face and, more particularly, warp-float belting came into use in northern Arizona as loom techniques. Evidence for this lies in one of the Awatovi murals (fig. 142, C). Warp-face fiber ties from the same village show that the technique was in use in the seventeenth century.

Among the Sinagua, Salado, and Hohokam the situation was somewhat different. By 1100 loom-woven

[83] Cosgrove, 1947: 73. Guernsey and Kidder, 1921: 75 and pl. 27, f.

[84] UM 29.43.105, 107 and 108.

[85] O'Neale, 1948: 106 and fig. 19*a*.

[86] This information is taken from the manuscript of Miss Marcelotte Leake in the Peabody Museum, Cambridge.

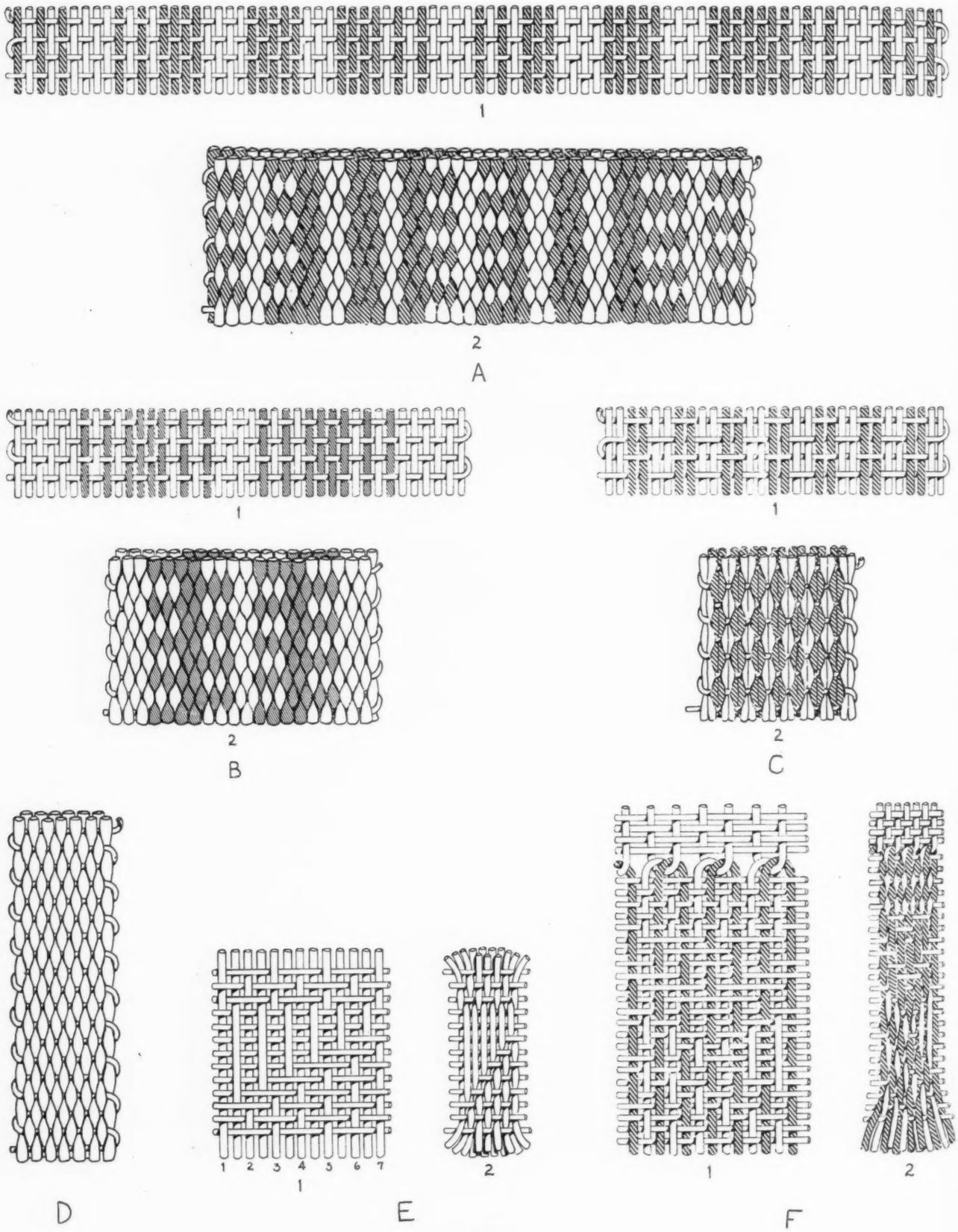


FIG. 53.

warp-face ties were used as breech cloth belting and in several other ways. It is possible that this custom was established very early among Mogollon-Pueblo and Hohokam, as the result of influences from northern Chihuahua, whence comes a warp-face fiber tie, possibly loom-woven, and dating from about 400. There is no evidence of *warp-float* belting anywhere in the Southwest, however, until after 1300, when it shows up at Tonto Monument. The appearance of this technique in southern Arizona must relate to the sudden flowering of warp-float belt weaving which Zingg speaks of as occurring in northern Mexico at about the time of the Conquest.[87] In other words, warp-float belting is a comparatively recent development in the Southwest and northern Mexico, springing into prominence between 1300 and 1600.

In Peru warp-float belt weaving is found in all horizons from A.D. 1 to the present. Currently such belting is produced by native weavers from northern Arizona and New Mexico south along the Cordillera into Chile, and in many villages of lowland Mexico and Guatemala. It is usually done on the belt loom.

Within the Southwest today belts, hair ties, and garters are woven by Hopi, Navaho, Zuni, and several Rio Grande Pueblos. They are generally of commercial string throughout, with wool warps and cotton wefts. The Hopi weave two types, both with warp-float patterns up the central panel: the "Hopi belt," for use by Hopi women and some trade to Zuni and Rio Grande towns; and the "squaw" or "Navaho" belt for trade to Navaho women, other Pueblos, local whites, and traders. The first has black, red, and green wool warps and black cotton wefts; the second red and green wool warps and some white cotton warps, and white cotton wefts. Heddle rigs and weave processes for the two types differ considerably, but warps for both types are strung in tubular fashion about short bars fastened between the upper and lower bars of the vertical loom. The belt loom and reed heddle formerly used by the Hopi have been discarded in recent years.[88]

Women's belts with a center warp-float panel were woven at Zuni by two methods until recently. One process, not recorded since 1916, involved use of the belt loom and reed heddle with warps *not* strung tubular fashion. The second, still employed to some extent, is that of tubular weaving in the Hopi manner.[89] Belts and other narrow warp-face ties are woven in several Rio Grande towns. The evidence is spotty, but red wool belts are said to be common at Santa Clara and San Juan; plain vertical striped belts are a Tewa specialty; and belts with a cross bar pattern are woven at San Juan and several Rio Grande towns.[90] Warp-float pattern weave belts, formerly woven in the Rio Grande Pueblos, are no longer being produced there, the current articles featuring only vertical warp stripes. Among the Navaho, belts with floated center panels are woven with tubular warps on a fixed frame, or on the belt loom with stick heddles. Among the Tarahumare and Maricopa (and probably formerly the Pima, Papago, and Opata) warp-float belts are woven on the horizontal loom with tubular warp rig.

The value of belting as a sales item for tourists undoubtedly accounts for its continued production in the Southwest, especially among the Rio Grande Pueblos where weaving of larger articles has virtually ceased.

[87] Bennett and Zingg, 1935: 95–96.

FIG. 53.

A. Brown and white warp-face belting. Cottonwood. (ASM 13389.) (1) Detail showing the order in which white and brown warps were strung. (2) Pattern produced by warps when they were pulled close so that the wefts were obscured.
B. Black and white warp-face belting. Hidden House. (ASM 20498 and 20499.) (1) Detail showing the order in which white and black warps were strung. (2) Pattern produced by the warps. (The pattern of dark warps in A, 2 and B, 2 will be more apparent if drawings are viewed with eyes squinted.)
C. Warp-face band, half-basket weave with paired brown and white warps. Gourd Cave. (ASM 3018.) (1) Shows the alternating of brown and white warp pairs. (2) The warp stripe pattern achieved by plain weave.
D. Plain weave warp-face belting with no variation in warp color.
E. Warp-float pattern weave. Tonto. (NPS–T 9/542.) (1) Threads separated to show warp-weft distribution. Numbered warps are those which normally appear on the surface of the cloth in plain weave. (2) "Pattern" made by floating underwarps on the surface.
F. Warp-float pattern weave with brown and white warps. Tonto. (NPS–T 9/207.) (1) Threads separated to show warp-weft distribution by which the pattern shown in (2) was created.

FLOATED WEAVES

Introduction

The term "floated weave" is applied to fabrics on which a pattern is built by warp or weft floats. Warp-float pattern weave was discussed above (pp. 531–535) along with warp-face plain weave. All the textiles described in the following section are *weft-face*, with patterns created by *weft* floats. Included are the many varieties of twill weaving, and weft-float pattern weave.

1. *Twill weaves*

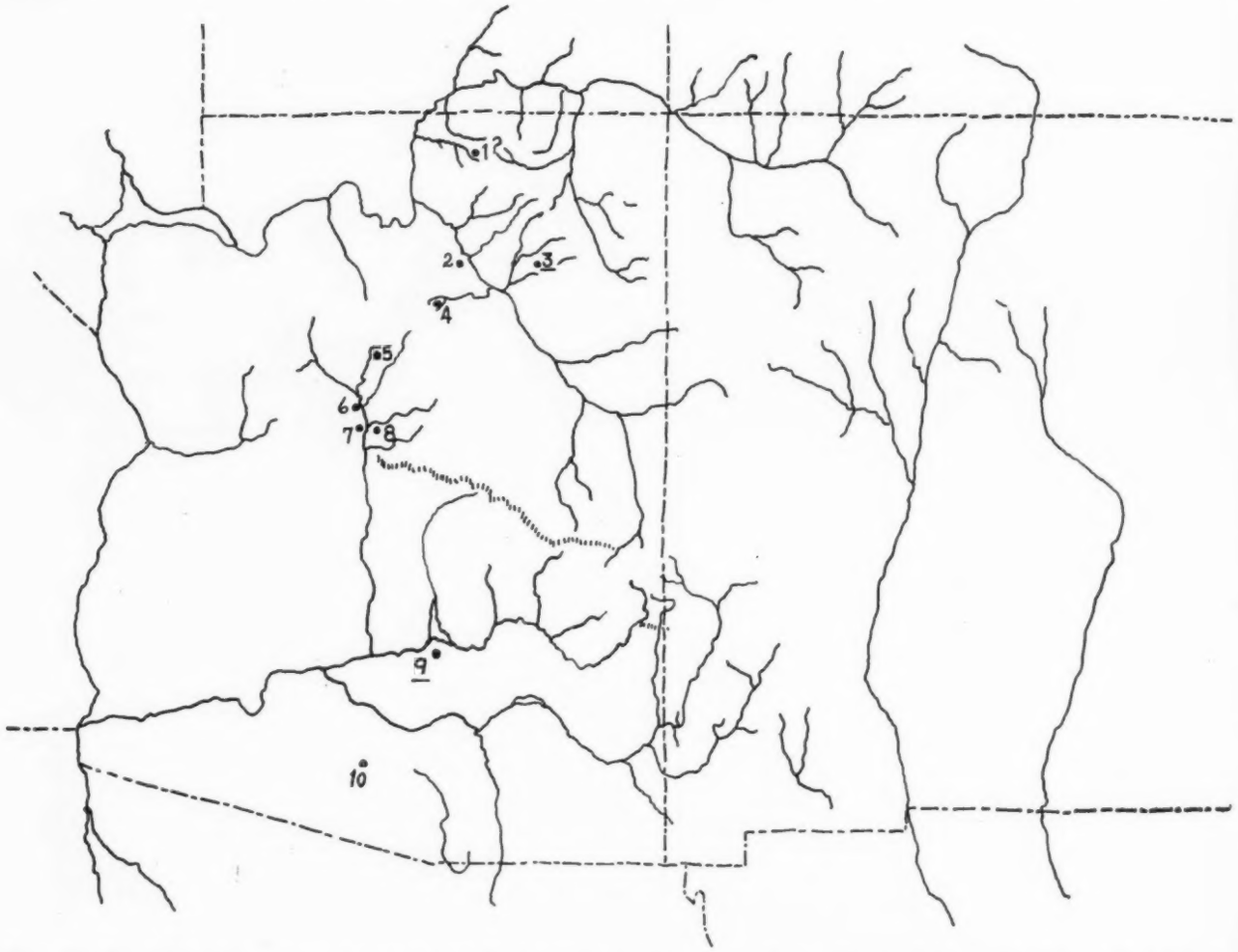
Definitions

Twill cloth may be recognized by the diagonal ribs which extend across the fabric. These ribs are made by the regular floating of wefts in echelon over two or more warps at a time. Five classes of twills may be distinguished, depending upon the pattern made by the lines of floats. These are:

Plain twill.—A twill in which the ribs slant across the fabric in one direction from one side to the other. This is also called a "continuous twill."

Reversed twill.—A twill in which the diagonal ribs

[88] MacLeish, 1940: 291–310.
[89] Spier, 1924: 74–78.
[90] Douglas, 1939*b*, *c*; 1940*b*, *c*.



MAP 7. The distribution of warp-face and warp-float pattern weave cloths. (A question mark is placed after number 1 (Gourd Cave) as the warp-face band from that site may not have been loom-woven. Those sites yielding both plain weave warp-face bands and warp-float pattern weave are underlined.) (1) Gourd Cave. (2) Wupatki. (3) Awatovi. (4) Walnut Canyon. (5) Hidden House. (6) Cottonwood. (7) Verde Valley. (8) Montezuma Castle. (9) Tonto. (10) Ventana Cave.

reverse direction at regular intervals so as to form vertical zigzag lines on the fabric (fig. 54).

Herringbone twill.—A twill in which zigzag lines run horizontally from side to side of the cloth. These lines are really composed of a series of half-diamonds touching at their side points, and warps are strung for diamond twill (fig. 59, A).

Diamond twill.—A twill in which the ribbing forms diamond patterns on the fabric (fig. 59).

Irregular twill.—A twill in which the ribbing forms patterns or figures (other than diamonds and regular zigzag lines) on the surface of the cloth (figs. 67, A; 70). "Fancy," "figured" and "broken" twill are other terms sometimes used for this type.

In addition to these five basic classes, there are certain twill weave processes which deserve special mention. First is the practice of building designs from different colored wefts, interlocking the wefts where they meet, and battening the picks close together This occurs within all twill classes, but is especially characteristic of irregular twills. Such cloth should be called "twill tapestry with interlocking wefts." Two other twill variants—double-weft twill and twill with brocade wefts—will be described and defined under separate headings in the following discussion.

Technical Descriptions

Introductory remarks.—The discussion of twill weaves brings us to a consideration of techniques widely practiced and thoroughly mastered by the prehistoric weavers, in particular those of the Anasazi area. Numerically, twill weaves stand second in importance to plain weaves, being represented by at least fifty-eight pieces from twenty-four (possibly more) sites.[91]

Twill cloth, like plain weave, is the product of a regular loom, and, with few exceptions, the floating of

[91] See Appendix C, chart 8, *a*.

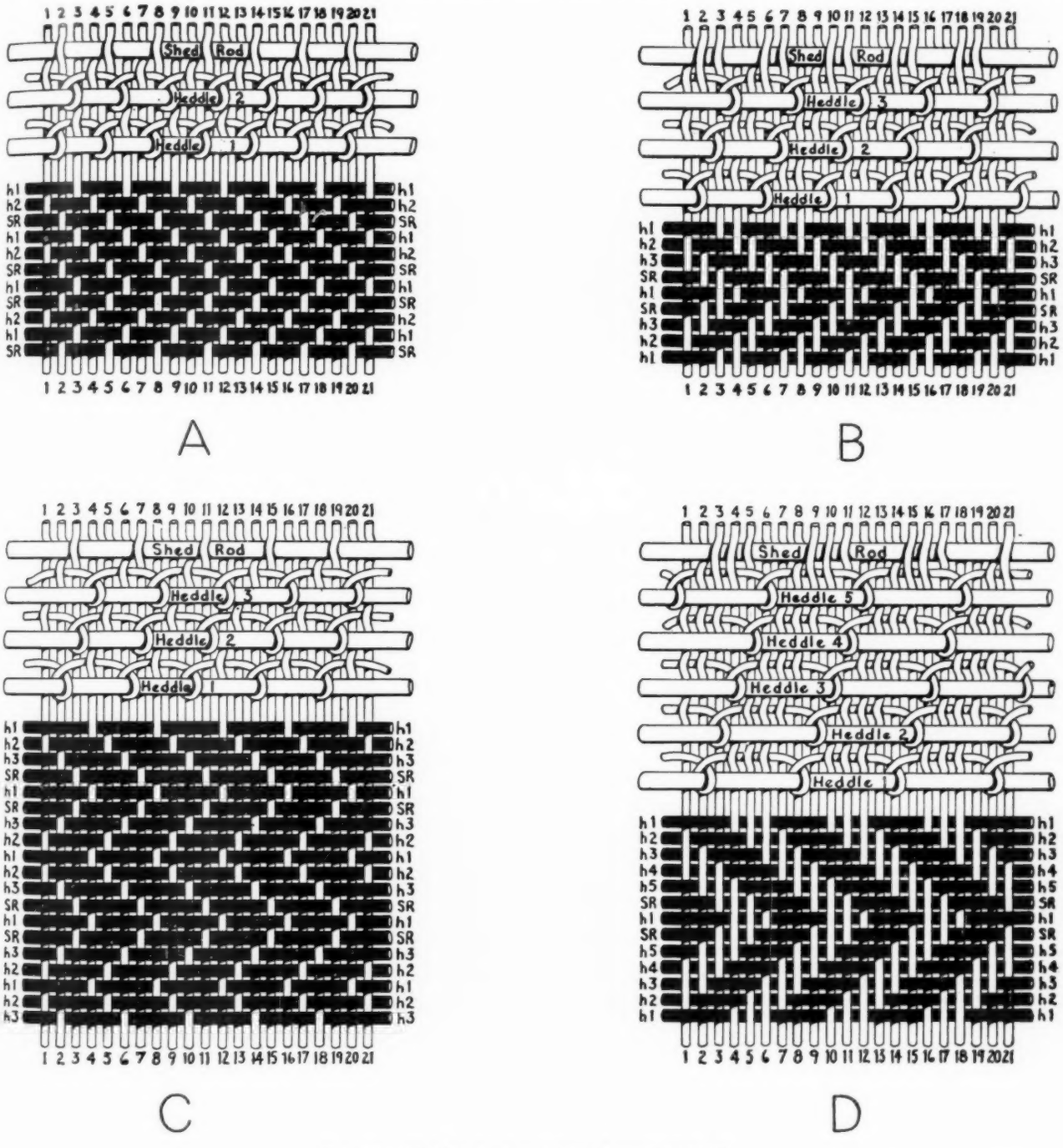


FIG. 54. Heddle rigs for plain and reversed twills.

A. Over-two under-one twill.
B. Over-two under-two twill.
C. Over-three under-one twill.
D. Over-three under-three twill.

(In order to see the pattern made by the lines of weft float, view the drawings with eyes slightly closed.)

wefts over successive pairs and triplets of warps was carried out with the aid of heddles. Ten basic heddle rigs have been noted for the series as a whole, five for plain or reversed twills, and five for diamond or herringbone twills. Irregular twills, as we shall see, were woven with one or another of the rigs used for plain twilling.

In working out the heddle rigs, I have assumed that

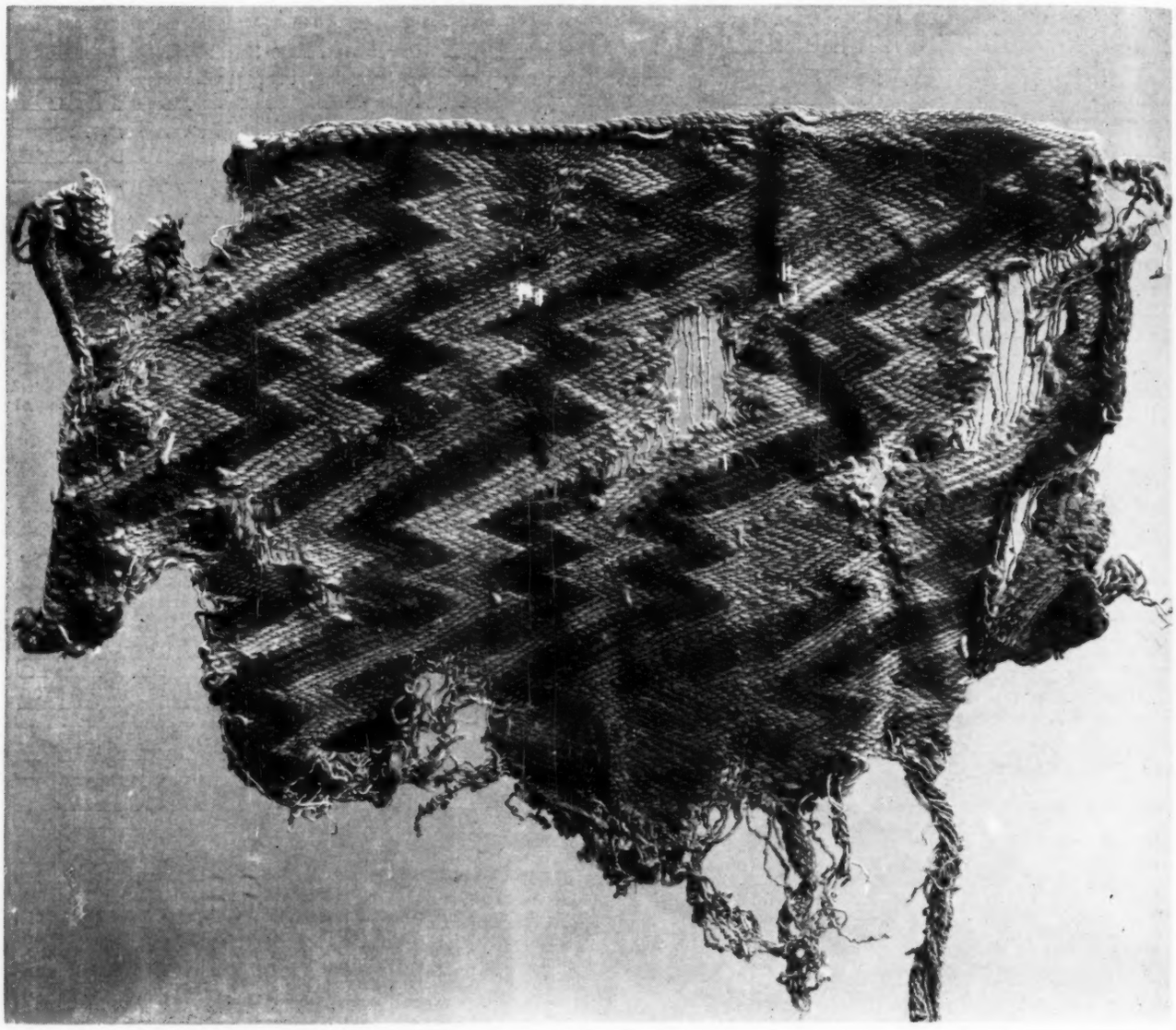


FIG. 55. Reversed twill tapestry with interlocked red, white, and brown wefts. Width, 10½". Southwestern Colorado. (UM 29.43.112. Photo by University Museum.)

methods used today by Pueblo and Navaho weavers are representative of those employed in the prehistoric Southwest. These are somewhat unlike the twill rigs familiar to contemporary white hand loom weavers of our own society. The basic difference is that native weavers string the heddles so that they pull only one for each pick of weft; while hand loom weavers often use a set of heddles for each weft shot.

Plain and reversed twills.—The distinction between plain and reversed twills is not based upon the way in which heddles are rigged. Any loom strung for plain twilling may be manipulated to produce a reversed twill pattern. The direction of the diagonal ribs may be changed at any point simply by reversing the order in which heddles are being pulled. A systematic shifting of heddle order results in zigzag lines running the length of the cloth. Little attempt is made in the following discussion to designate which cloths are patterned in plain and which in reversed twill.

Over-two, under-one twill.—Fifteen pieces,[92] all from Mesa Verde Branch Anasazi sites, are woven with this rhythm. (Figured twills produced with the same heddle rig are described on pages 553–554.) Each weft floats over two warps, under one warp, over two warps, under one warp, and so on for the width of the web.

[92] See Appendix C, chart 8, *a*: AMNH 29.1/7547, 29.1/7679B, C, D, 29.1/7710 and 29.1/7991, White House. ASM 16142, Zele Cave. BM 12653, Canyon de Chelly. CSHS 01454 and 01461, Mesa Verde. CU no number, Aztec. NMSM Acdc 25/1, Canyon de Chelly. PM A1709, Waterfall Ruin. PM 33-62-10/2012, Turkey Kiva, Floating House. UM 29.43.112, "Southwestern Colorado." USNM 257.363, Mesa Verde (?). Haury, 1945*b*, Painted Cave.

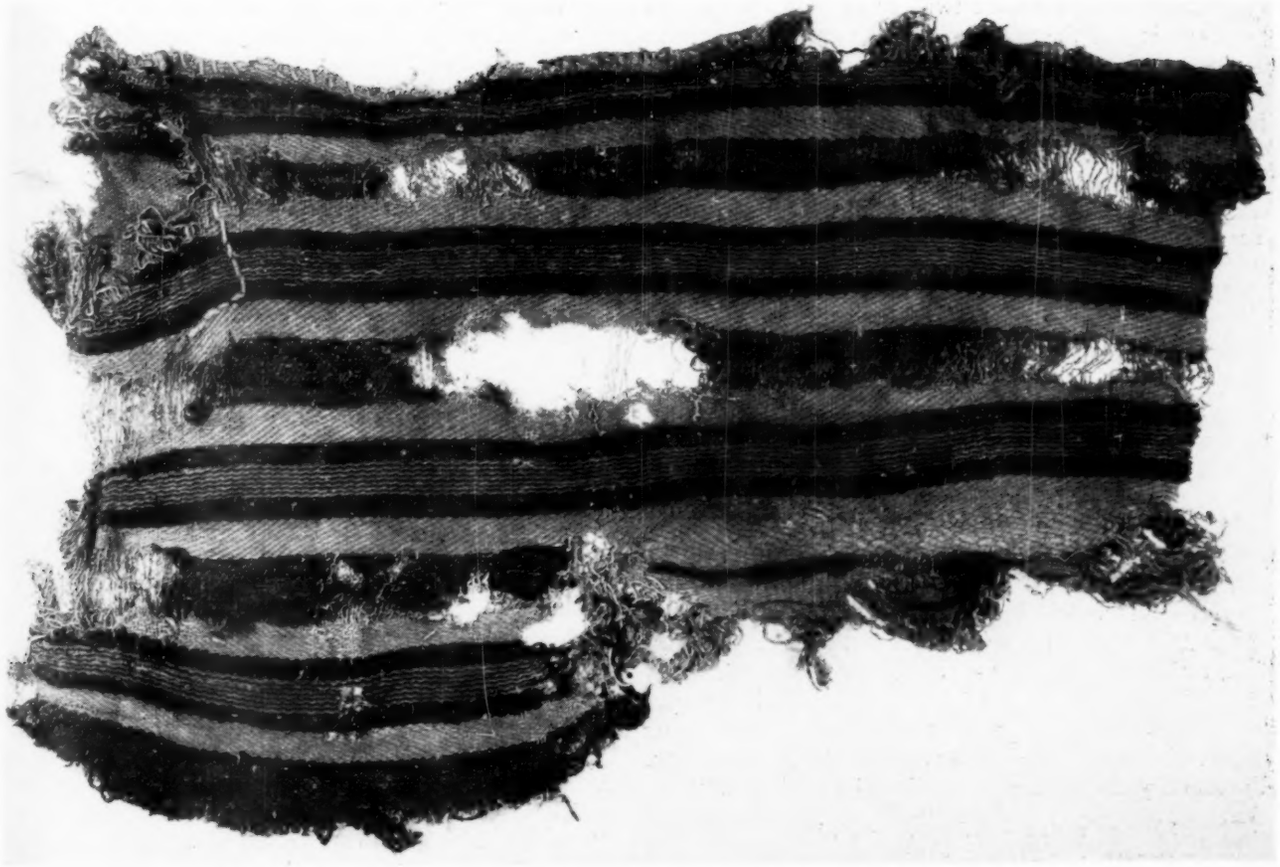


FIG. 56. Anasazi stripe twill cloth from Canyon de Chelly. Width (incomplete), 20".
(BM 12653. Photo by Brooklyn Museum, neg. no. 765.)

In each succeeding shed the warp pairs over which the weft passes are set over one thread to the right or left. The loom is strung with two heddles and a shed rod. As illustrated in figure 54, A, heddle one pulls forward every third warp, or numbers 3–6–9–12, etc. Heddle 2 pulls forward every third warp starting one over to the right, or numbers (1)–4–7–10–13, etc. The shed rod forces forward every third warp starting yet another warp to the right, or numbers (2)–5–8–11, etc. In other words, each control governs the following warps:

Shed rod:	–	2	–	–	5	–	–	8	–	–	11	–
Heddle 2:	1	–	–	4	–	–	7	–	–	10	–	–
Heddle 1:	–	–	3	–	–	6	–	–	9	–	–	12

(Heddle 1 is shown at the bottom of the column, with heddle 2 and the shed rod above it, since that is their order on the loom.) By pulling these controls in regular ascending order—H1, H2, SR, H1, H2, SR—a diagonal rib of weft floats slanting up to the right is made. If the heddle order is reversed—SR, H2, H1, SR, H2, H1—the ribs will slant up to the left.[93]

With two exceptions, all the over-two under-one twills may be classed, on the basis of design style, as "Anasazi twills," those fabrics distinguished by weft-stripe patterns in black or brown, red and white (see pp. 563–565). One of the exceptions is a reversed twill in natural color cotton, the front section of a breech cloth from White House. (AMNH 29.1/7710, pp. 610–613). The other (UM 29.43.112, from "Southwestern Colorado") is a twill tapestry with interlocking wefts in white, red, and brown. Each color stripe is four twill ribs wide. A "lightning" design is made with these stripes by alternately weaving a long diagonal and a compressed zigzag in reversed twill.[94] The piece has a complete width of 10½ inches, and one warp selvage, with a narrow end border of white plain weave. It may be the decorated end of a breech cloth or a sash

[93] Patterns made by the weft floats will be more clearly seen if all twill figures are viewed through slightly closed eyes.

[94] It might be argued that this piece should be classed and described as a figured twill, since the ribs form a distinct pattern other than regular zigzags or diamonds. However, there is no irregularity in heddle order, nor are several heddles pulled for a single pick of weft, two factors which, as we shall see, are basic in weaving all the other fabrics called figured twill. Furthermore, if it were not for the presence of colored weft ribs there would be no lightning pattern, but simply a reversed twill with a rather unusual rhythm in the shift of the diagonals.

(fig. 55). The Anasazi twill from Aztec (CU, no number) is also the end of a narrow cloth, in this case 8½ inches wide. It appears to have had a fringe along the warp selvage. A third fragment (CSHS 01461), from Mesa Verde, is 6½ inches wide at its torn edge, and narrows to a width of 4½ inches at the warp selvage. Here the cloth is gathered in by tying together the warp and weft selvage cords from the two corners. There is an end border of plain weave. Certainly this fragment has the appearance and shape of a breech cloth front (pp. 609–613). There is no hint of the original size of other over-two under-one twills with the exception of a large Anasazi twill fragment from Canyon de Chelly (BM 12653; fig. 56) with an incomplete width of 20 inches. Worn and patched, this may be the remains of a blanket. One of the patches is an over-two under-two diamond twill cloth (p. 543).

The plain weave borders on these twill cloths were either picked in by hand, the heddles being strung only for twill weave, or two additional heddles governed the plain weave.

Over-one, under-two twill.—The opposite of the above twill rhythm has been noted but once, in the plain twill section of the cloth from White House (AMNH 29.1/7679A) described under "three-thread diamond twill" (pp. 547–549). In this case the long weft floats are on what appears to be the undersurface of the cloth. Presumably the heddles were rigged as follows:

Shed rod:	1, 2 – 4, 5 – 7, 8 – 10, 11 – 13
Heddle 2:	1 – 3, 4 – 6, 7 – 9, 10 – 12, 13
Heddle 1:	– 2, 3 – 5, 6 – 8, 9 – 11, 12 –

It would be possible to weave a twill of this kind with the heddles rigged for over-two under-one twill, by pulling pairs of heddles for each weft pick, a method followed by white hand-loom weavers. I have never observed or heard mention of such a practice among contemporary Pueblo weavers. There are some modern twill weave dresses and shirts decorated with narrow "indented" lines three or four weft picks wide. These are made by shifting the twill rhythm so as to throw the long floats to the underside of the cloth instead of the surface. It hardly seems reasonable that the weaver would re-string the heddles for so few weft picks. There are two alternatives. Either he pulled paired heddles, or he selected warp sets by hand for those weft rows. I favor the latter method, especially as some of the indented lines do not extend the full width of the web.[95]

Over-two, under-two twill.—A second widely used twill rhythm is that in which wefts float over two warps, under two warps, over two warps, under two warps, and so on. There are at least twenty examples of this type.[96] (Figured twills woven with this rhythm are described on p. 555.) All are from Anasazi sites except four from Wupatki, Kinishba and Tonto Monuments.

Three heddles and a shed rod are required for such a twill. The heddle rig is illustrated in figure 54, B. The first heddle pulls forward every other pair of warps starting with numbers 3 and 4. The last warp of each pair becomes the first warp of each pair governed by the succeeding heddle. Each line of weft floats is thus set over a warp to the right of the line below it. Briefly, the heddles and shed rod control the following warps:

Shed rod:	– 2, 3 – – 6, 7 – – 10, 11 – – 14, 15 –
Heddle 3:	1, 2 – – 5, 6 – – 9, 10 – – 13, 14 – –
Heddle 2:	1 – – 4, 5 – – 8, 9 – – 12, 13 – – 16
Heddle 1:	– – 3, 4 – – 7, 8 – – 11, 12 – – 15, 16

Fifteen of the over-two under-two twills are of the Anasazi design type. Two reversed twills from Wupatki (MNA 484/2399a and 850/NA35.1), and diagonal twills from Navaho National Monument (USNM Y) and Tonto Monument (NPS–T X–38) do not belong in that classification. The Tonto twill is exceptionally well woven, the finely-spun warps numbering forty to the inch, while close packed, soft wefts number thirty-two. There is no information on the design of the Kinishba piece.

All but two of these twills are small scraps giving no hint of the original sizes or uses of the cloths from which they were torn. One of the two is a knife case (UM 29.43.153) from "Southwestern Colorado" made by folding lengthwise, and sewing, a 6½-inch-wide cloth (fig. 57). The other is a fragmentary blanket (NPS–AM 954 and 4000) from Aztec.

Over-three, under-one twill.—This type of twill is represented by only one small fragment of cloth (MNA 695/NA2519.M259) from Kiet Siel. It is woven from two-ply white cotton throughout, the wefts being so loosely twisted they appear to be paired threads. Three heddles and a shed rod are needed for this weave, each control pulling forward every fourth warp, as follows (fig. 54, C):

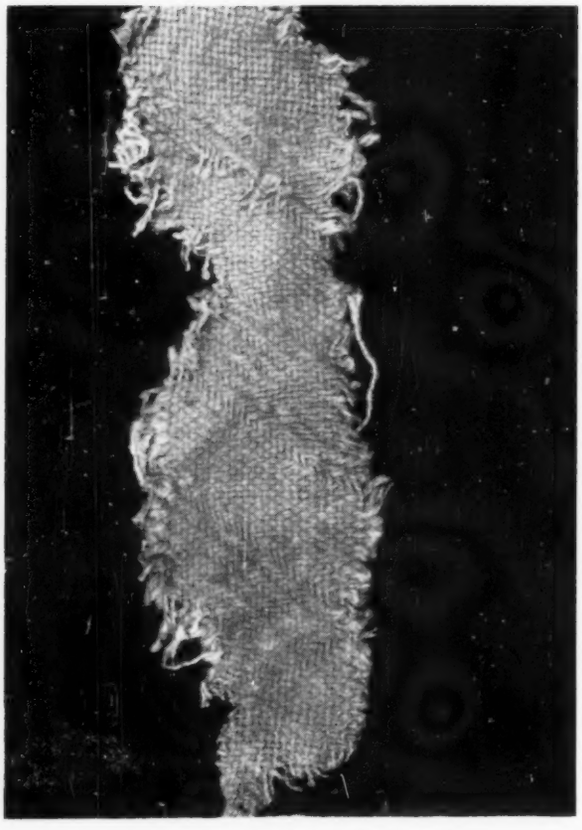
Shed rod:	– – 3 – – – 7 – – – 11 – – – 15
Heddle 3:	– 2 – – – 6 – – – 10 – – – 14 –
Heddle 2:	1 – – – 5 – – – 9 – – – 13 – –
Heddle 1:	– – – 4 – – – 8 – – – 12 – – –

Over-three, under-three twill.—Almost as rare is the form of twilling in which each weft floats over three warps, under three warps, over three warps, under three warps, and so on. One example, from Wupatki (MNA 77/NA405.M235), is a small cloth with a com-

[95] Douglas, 1940*c*: 182, I and N, shows photographs of a shirt and dress decorated by rows of indented wefts.

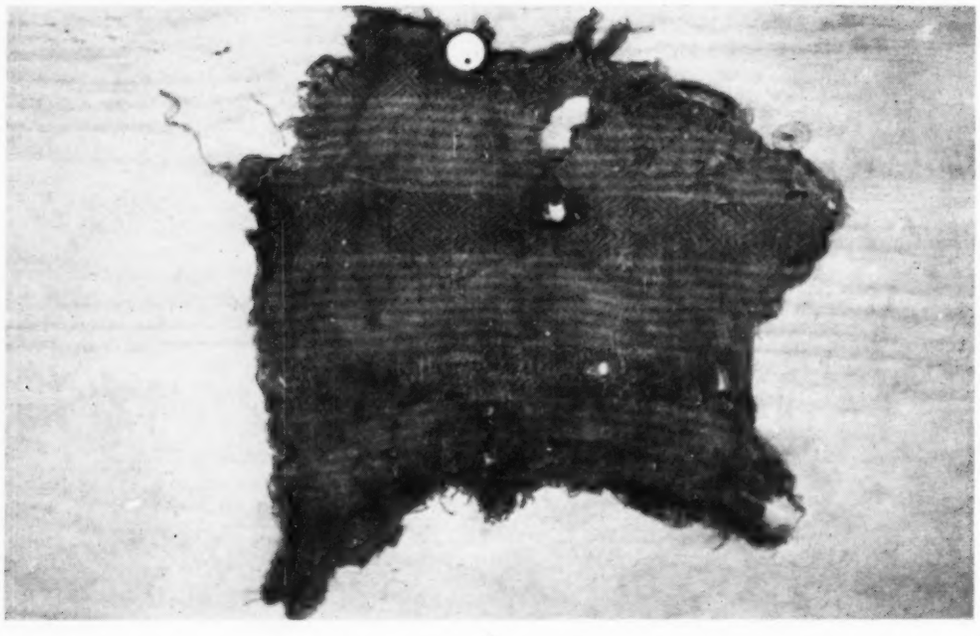
[96] See Appendix C, chart 8, *a*: AMNH H/3151, H/7690 and H/9465, Pueblo Bonito. AMNH H/13468, H/13836 and H/14565, Grand Gulch or Kayenta. CSHS 01460, Mesa Verde. LA L.30/109, Black Creek. LA L.30/139, Hospitibito Canyon. MNA 484/2399a and 850/NA35.1, Wupatki. MNA 695/NA2519.784, Kiet Siel. NMSM, Field Cat. #783–791, 2 pieces, Chetro Ketl. NPS–AM 954 and 4000 (one cloth), Aztec. NPS–T X–38, Tonto. PM A1620, Marsh Pass, Cliff House #8. UM 29.43.153, "Southwestern Colorado." USNM Y, Navaho National Monument. Baldwin, 1939: 321, Kinishba.

FIG. 57. Knife bag made from a reversed twill cloth with weft stripes in white, brown, and red. Length, 8¼". Southwestern Colorado. (UM 29.43.153. Photo by University Museum.)



A

B



C

FIG. 58. A. A combination of plain and twill rhythms creating a self-pattern on a cloth from Wupatki. (MNA 627/405.M224(b). Photo by Museum of Northern Arizona.) B. Over-three under-three reversed twill. Width, 6". Wupatki. (MNA 77/NA405.M235. Photo by Museum of Northern Arizona.) C. Diamond twill, Anasazi stripe design in white, red, and black. Aztec. (NPS–AM 5338. Photo by A. Kent.)

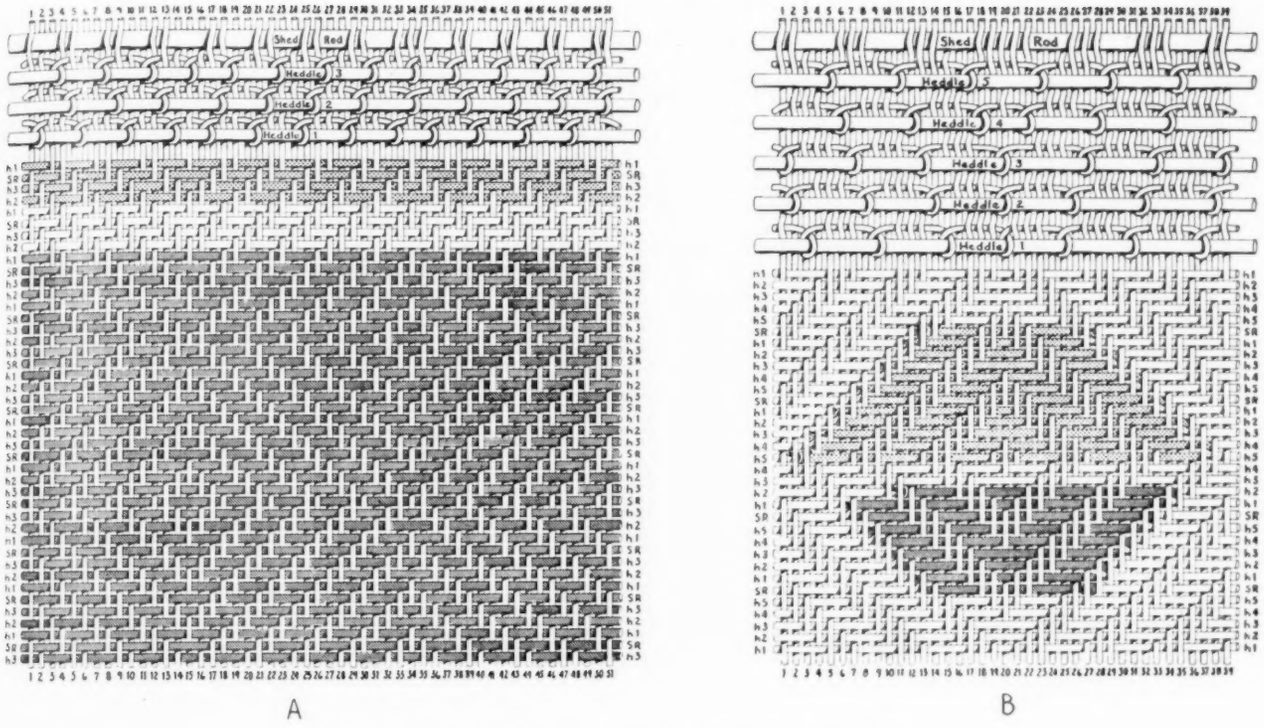


FIG. 59. Heddle rigs for diamond and herringbone twills.

A. Over-two under-two twill. Aztec. (NPS–AM 5338.)
B. Over-three under-three twill. This shows the use of red and black weft threads to accentuate the diamond pattern, as found in the diamond twill from Montezuma Castle. (NPS–MC 56.)

plete width of 6 inches and one remaining warp selvage. A fringe runs along this selvage (see p. 578; fig. 94, H) and just inside it is a plain weave border 1½ inches wide (fig. 58, B). The wefts in this border are coarse two-ply reddish-brown threads, as are the warps of the cloth as a whole. Wefts in the body of the cloth are two-ply black threads, woven in a reversed twill pattern. The piece may be the remains of a small bag, or the end of a sash or breech cloth.

Over-three under-three twill is accomplished by stringing the loom with five heddles and a shed rod. Heddle 1 pulls forward every other triplet of warps commencing with numbers 4, 5 and 6. The middle warp of each triplet governed by a given heddle becomes the first warp in each triplet controlled by the succeeding heddle. Heddles and shed rod control the following warp sets (fig. 54, D):

Shed rod:	– – 3, 4, 5 – – – 9, 10, 11 – – – 15
Heddle 5:	– 2, 3, 4, – – – 8, 9, 10 – – – 14, 15
Heddle 4:	1, 2, 3 – – – 7, 8, 9 – – – 13, 14, 15
Heddle 3:	1, 2 – – – 6, 7, 8 – – – 12, 13, 14 –
Heddle 2:	1 – – – 5, 6, 7 – – – 11, 12, 13 – –
Heddle 1:	– – – 4, 5, 6 – – – 10, 11, 12 – – –

An over-three under-three heddle rig was also used in weaving the figured twill tapestry with interlocking weft from Hidden House described on page 555, and six controls were needed for the Montezuma Castle diamond twill (p. 545).

Diamond and herringbone twills.—A diamond or herringbone pattern may be woven if heddles are strung so that lines of weft floats angle from regularly spaced warps up to right and left. If the heddles are pulled repeatedly in regular ascending order a series of horizontal zigzag lines running from side to side of the web will be made—in other words, a herringbone twill pattern. In a herringbone twill each zigzag line is actually a row of half diamonds, touching at their side points. The second half of the diamonds is woven when the heddle order is reversed.

The collections include nine fragments of diamond and herringbone twill woven with five different heddle rigs. Included are: four-thread diamond twill; over-two, under-two diamond twill; over-three, under-three diamond twill; and two varieties of three-thread diamond twill. Five of the fragments, all except those listed as over-two, under-two twills, are tapestry weaves with interlocking wefts.

Over-two, under-two diamond twill.—Four pieces of cloth [97] all from Anasazi sites are woven in a diamond

[97] See Appendix, chart 8, *a*: BM 12653, Canyon de Chelly. This is a patch on the Anasazi stripe cloth listed also under "over-two, under-one plain or reversed twills" (p. 538). NPS–AM 5338, Aztec. PM 33–62–10/1996, Kiva 1, Floating House. UM 29.43.122, "Southwestern Colorado."

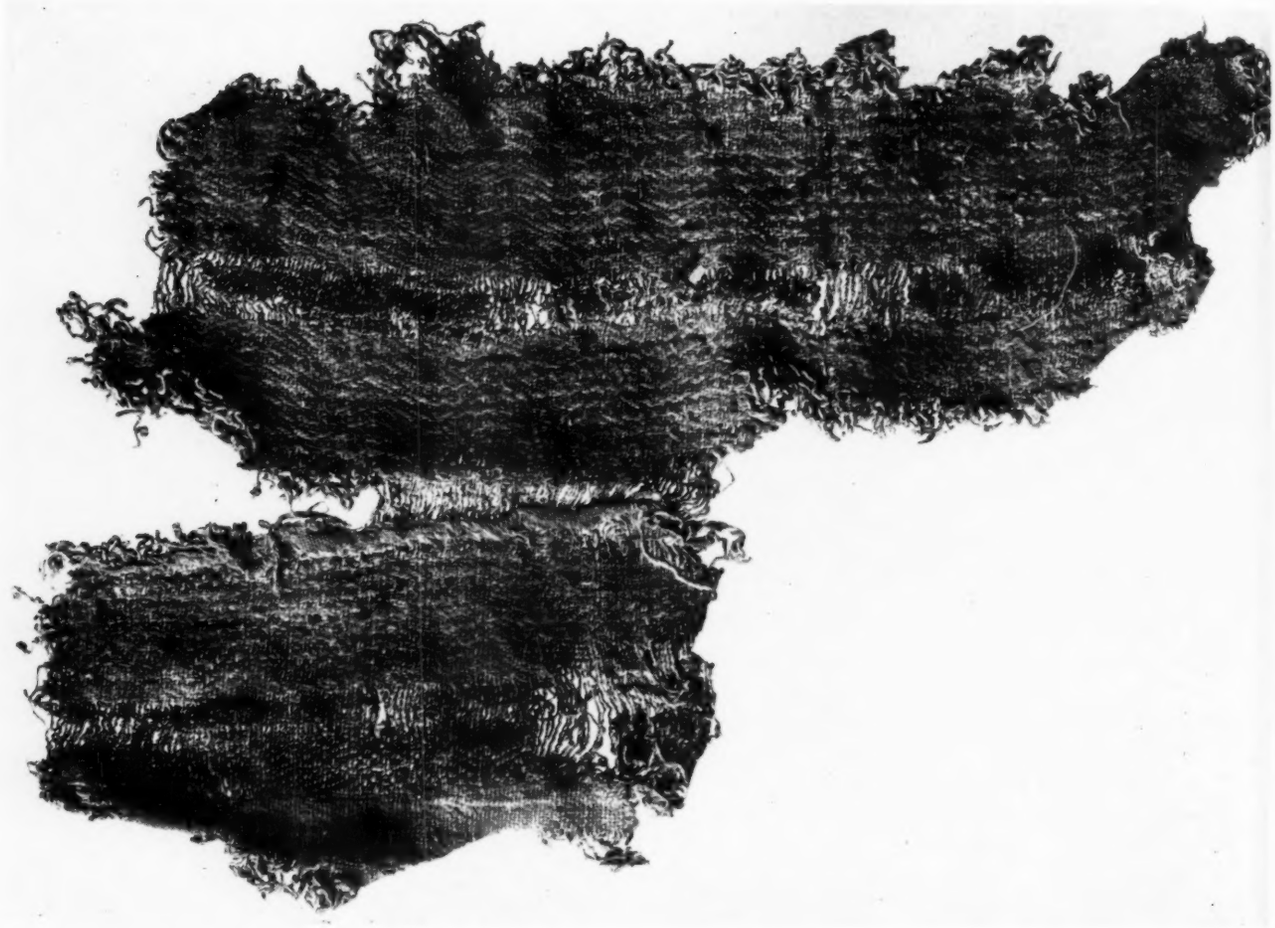


FIG. 60. Anasazi stripe diamond twill cloth, with red, yellowish-brown, and white wefts. The diamond figures are completed only in the brown weft bands, which have largely worn out of the cloth. Southwestern Colorado. (UM 29.43.122. Photo by University Museum.)

twill which, like over-two under-two diagonal twill weave, requires the use of three heddles and a shed rod. Warps are strung as for plain twilling, except that at regular intervals the clasp-two, drop-two rhythm is broken. It is at such points that lines of weft floats angle out to form the lower half of a diamond, or converge to form its upper half.

For example, in the diagram of a diamond twill from Aztec (fig. 59, A) rhythm changes occur at warps number 15 and number 34. There will be similar breaks at every nineteenth warp thereafter. Here heddle 1 pulls forward a *single* warp, number 15 or number 34, rather than the customary pair. Heddle 2 pulls forward *three* warps, numbers 14, 15, and 16, at the first point of change, and drops *three* warps, numbers 33, 34, and 35 at the second point of change. (This alternate clasping and dropping of triplets of warps will be carried out at every nineteenth warp.) Heddle 3 drops only *one* warp, number 15 or number 34, instead of the customary pair. The shed rod drops *three* warps, numbers 14, 15, and 16 at the first rhythm break, and clasps *three*, numbers 33, 34, and 35 at the second. Warp sets governed by each control are shown on page 545.

The Aztec, Canyon de Chelly, and "Southwestern Colorado" twills are of the Anasazi design style, with a herringbone pattern of half-diamonds in the red and white stripes and complete diamond figures in the brown or black weft bands (figs. 58, C; 59, A; 60; 81, E). The fourth fragment, from Floating House Ruin, is a fine, even weave with brown wefts on white warps. None of the pieces is identifiable to use.

Four-thread diamond twill.—A second type of four-thread diamond twill was found in Tularosa Cave.[98] This is a tapestry weave, with blue, brown, and natural white wefts which interlock at points of contact. The interlocking takes place along the edges of diamonds. Wefts are tied in with square knots when first introduced. Additional lengths of thread added in the midst of a colored section are not tied, however, but overlap for a short distance. The twill design is set into a plain

[98] Martin *et al.*, 1952: 299–300. I am indebted for information about this piece to Miss Elaine Bluhm and Mr. Keith A. Dixon.

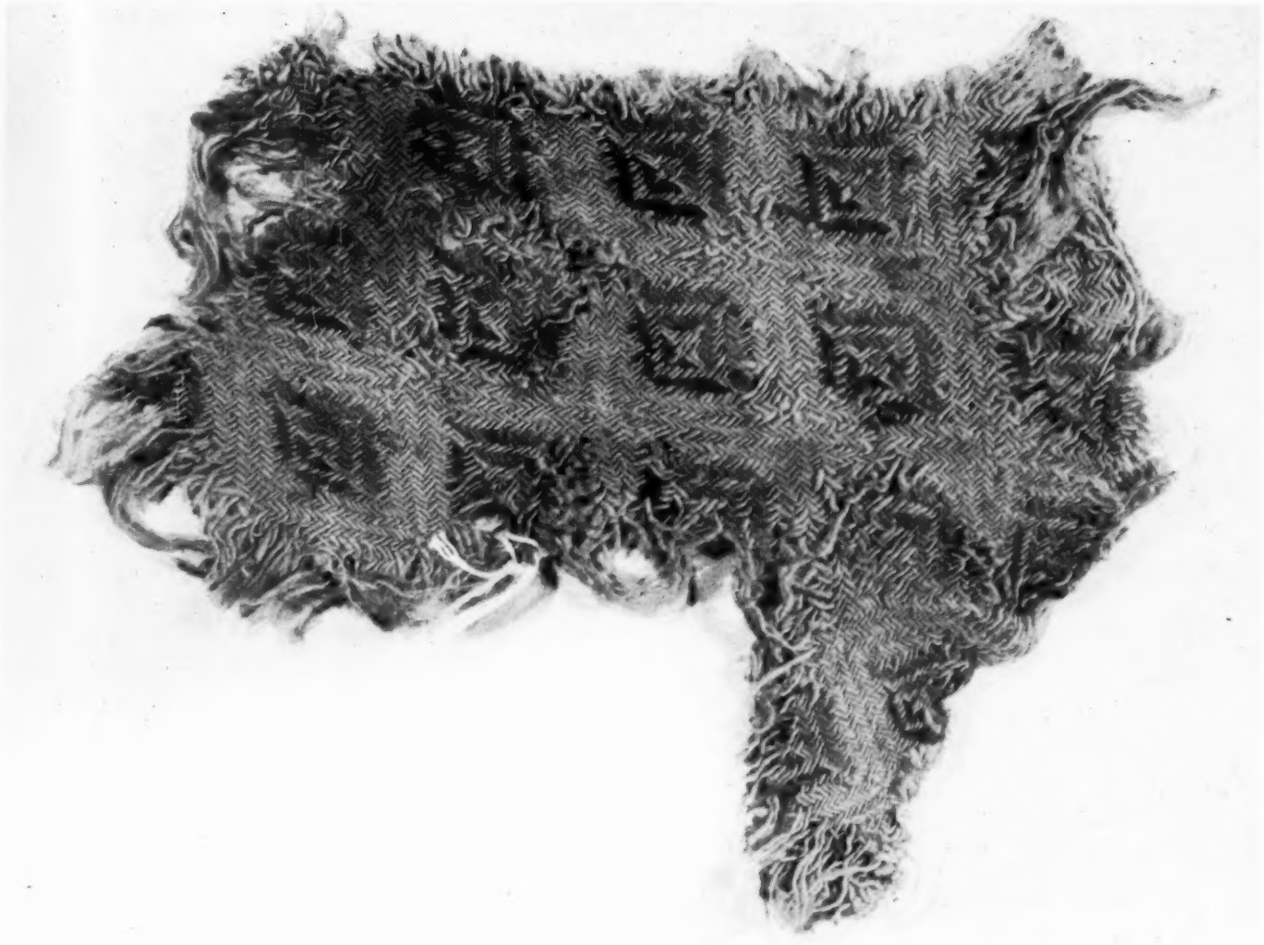


FIG. 61. Fragment of diamond twill tapestry with interlocking red, black, and white wefts. Over-three under-three rhythm. In this photograph the warps slant up to the right. Montezuma Castle. (NPS-MC 56. Photo by Denver Art Museum.)

weave cloth. It may have been a unit pattern on a large cloth, or one of a series of design units placed along the border of the cloth, or at the end of a plain weave sash.

Over-three under-three diamond twill.—Five heddles and a shed rod were needed to weave the diamond twill from Montezuma Castle (NPS–MC 56) (fig. 61). (This piece is illustrated and described in Amsden,[99] where, however, it is referred to as a finger-weave, or one in which warp sets were picked out by hand for each weft pick.) The over-three under-three rhythm breaks along warp number 20 in the technical drawing (fig. 59, B). It will break again at warp number 45. A pleasing effect is made by dividing the inner portion of each diamond on its horizontal axis into two parts, one woven in red wefts, the other in black. Colored threads are knotted to white wefts as needed, and woven back and forth for the desired distance, looping through white wefts at their edges. The heddle rig is shown on page 547.

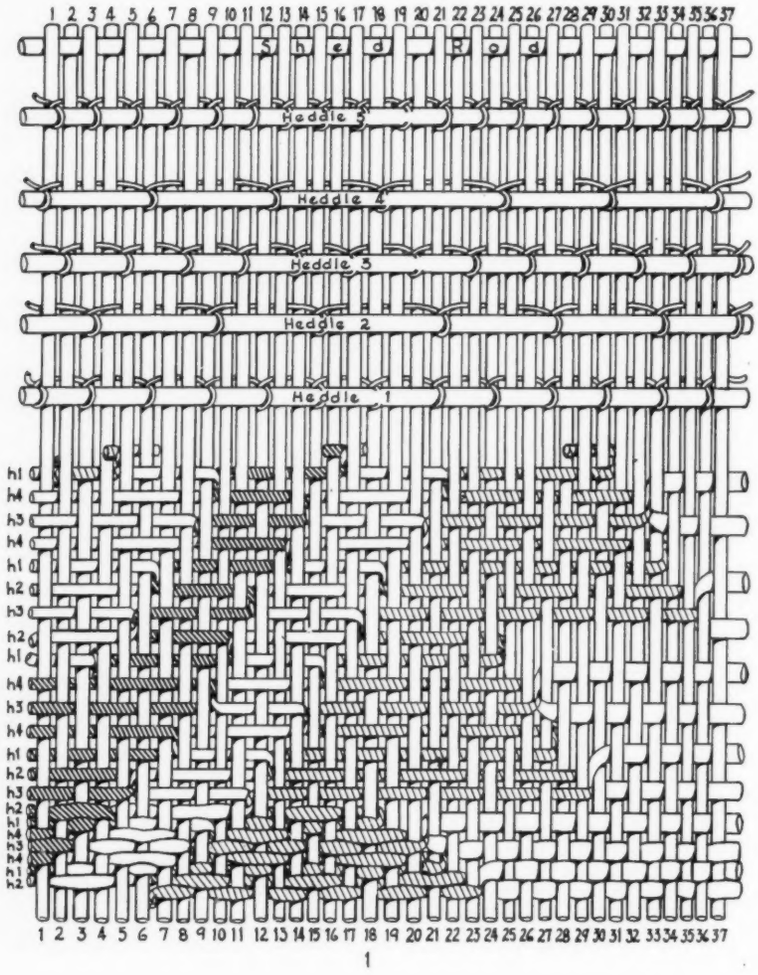
The design and heddle rig are illustrated in figure 62, A (see also fig. 63). The four heddles control the following warp sets:

Heddle 4: – 2, 3, 4 – – – 8, 9, 10 – – – 14, 15, 16 – – – 20, 21, 22
Heddle 3: – – 3 – – 6 – – 9 – – 12 – – 15 – – 18 – – 21 –
Heddle 2: 1 – – – 5, 6, 7 – – – 11, 12, 13 – – – 17, 18, 19 – – –
Heddle 1: 1, 2 – 4, 5 – 7, 8 – 10, 11 – 13, 14 – 16, 17 – 19, 20 – 22

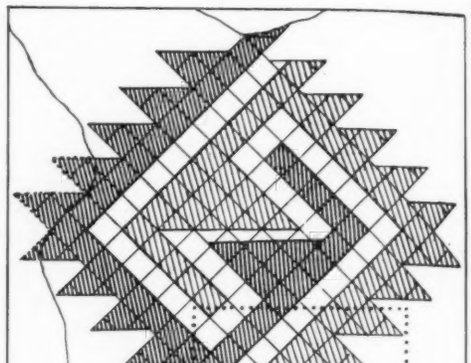
Over-two, under-two diamond twill:

SR: 1 – – 4, 5 – – 8, 9 – – 1213 – – –1718 – –2122 – –2526 – –2930 – –333435 – –3839 –
H3: 1, 2 – – 5, 6 – – 9, 10 – –1314 –1617 – –2021 – –2425 – –2829 – –3233 –3536 – –3940
H2: – 2, 3 – – 6, 7 – – 1011 – –141516 – –1920 – –2324 – –2728 – –3132 – – –3637 – –40
H1: – – 3, 4 – – 7, 8 – – 11, 12 – –15 – –1819 – –2223 – –2627 – –3031 – –34 – –3738 – –

[99] Amsden, 1949: pl. 35, *c*.

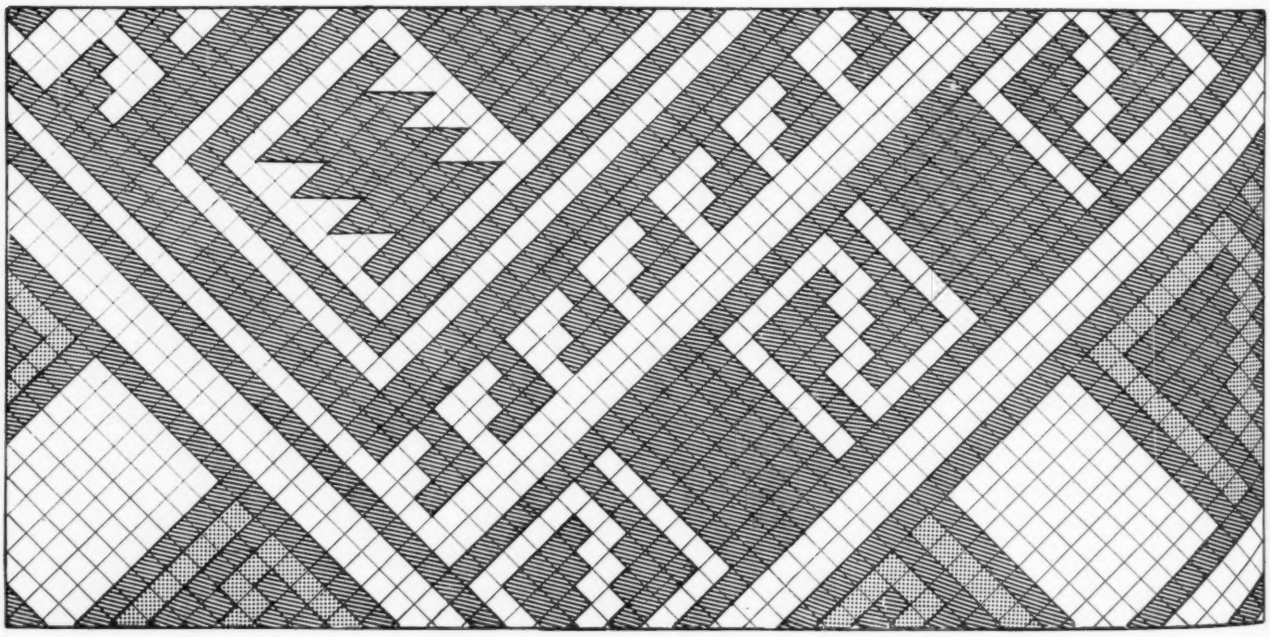


1



2

A



B

FIG. 62.

Over-three, under-three diamond twill:

SR: 1, 2 – – – 6, 7, 8 – – –121314 – – –1819202122 – – –262728 – – –323334 – – –383940 – – –444546 – – –50
H5: 1, 2, 3 – – – 7, 8, 9 – – –131415 – – –192021 – – –252627 – – –313233 – – –373839 – – –4344454647 – – –
H4: – 2, 3, 4 – – – 8, 910 – – –141516 – – –20 – – –242526 – – –303132 – – –363738 – – –424344 –464748 – –
H3: – – 3, 4, 5 – – – 91011 – – –151617 – – – – –232425 – – –293031 – – –353637 – – –414243 – – –474849 –
H2: – – – 4, 5, 6 – – –101112 – – –161718 – – –222324 – – –282930 – – –343536 – – –404142 – – – – –484950
H1: 1 – – – 5, 6, 7 – – –111213 – – –171819 –212223 – – –272829 – – –333435 – – –394041 – – –45 – – –4950

Three-thread diamond twills.—There are three fragments of diamond twill woven on a loom rigged with only three controls, two heddles, and a shed rod. These may be called three-thread diamond twills.[100] All are tapestry weaves with interlocking wefts. One is the cloth from Grand Gulch which has usually been referred to as a kilt (figs. 62, B; 64). This has a complete warp stretch of 55½ inches, with borders of plain weave about 3 inches deep at top and bottom selvage. The cloth is now 24 inches wide, but examination shows that one weft selvage is completely missing. In other words the original width is unknown. Recent measurement of fragments of this cloth in the Museum of the American Indian collection establishes the fact that the piece was originally a blanket.[101] The design elements are in three colors—red, brown, and white. The piece appears to have been scorched, which would account for the blackish tinge of some brown wefts, and for certain yellowish wefts which I believe were originally white.

The pattern, like that of the Tularosa Cave piece, is composed of sets of small design elements. Each element is built up with one color thread from an established number of diamonds placed in the same relative position. Elements in turn are combined into larger design units which take the form of rectangular blocks or bands offset around diamond shaped units. The oblique lines along which elements are placed are either one or two diamonds in width. Rigging the loom for diamond twill is an ingenious way of acquiring an automatic guide for keeping the design elements uniform and in correct relationship to one another. Presumably the weaver first conceived the over-all pattern and then was able to reduce it in his mind to its component parts—fairly large design blocks, composed in turn of small elements, with each element containing a certain number of diamonds. When he commenced weaving he had to keep all this in mind and further reduce the pattern to its ultimate essentials, that is, horizontal lines of weft picks. Reichard, in her discussion of Navaho weaving, has defined in the following words the point of view a weaver must be able to maintain in creating a pattern of this type:

> . . . *The weaver must keep the composition of the entire rug surface in her mind, but she must see it as a huge succession of stripes only one weft strand wide.* It matters not how ideal her general conception may be, if she cannot see it in terms of the narrowest stripe, meaning a row, of properly placed wefts, it will fail of execution.[102]

The two other three-thread diamonds twills are patterned in brown and white interlocking wefts. One comes from an unknown site in northern Arizona (MNA 1233/A1481) and the other from Room 6, White House (AMNH 29.1/7679A). The first is illustrated in figures 65, A, B, C, and 66. Figure 65, A shows the heddle rig. Heddle 1 pulls forward every third warp, or numbers 1 – – 4 – – 7, etc., allowing the weft to float over pairs of warps. Heddle 2 pulls forward warps 3 – 5 – – – 9 – 11 – – – 15 – 17, etc., so that the weft floats first over one warp, then over three, alternating this rhythm across the web. The shed rod pushes forward warps 2 – – – 6 – 8 – – – 12 – 14, etc., and the third weft pick floats over three warps, then over one, and repeat—or in a rhythm exactly the reverse of the weft governed by heddle 2. Examination of the diagram will show that heddles are pulled in regular ascending order for the first ten twill weft picks, thus building a herring-bone twill pattern. A row of diamonds is completed when the shed rod is pulled for weft 11 and heddle 2 for weft 12. These diamonds have their lower points along the eighth weft pick, on warps 4, 10, 16 and every six warps thereafter; and their upper points on the same warps along weft pick number 12. Simultaneously a row of diamonds with their lower points along weft 11 on warps 1, 7, 13, 19, etc. is commenced. A pattern of small nested diamonds is thus produced with the following heddle rhythm:

H1, H2, SR, H1, SR, H2; and repeat.

Although this and the White House fragment are essentially the same technically, there is a rather interest-

[100] See Appendix C, chart 8, *a*: AMNH H/15982, Grand Gulch. AMNH 29.1/7679A, Room 6, White House. MNA 1233/A1481, Northern Arizona.

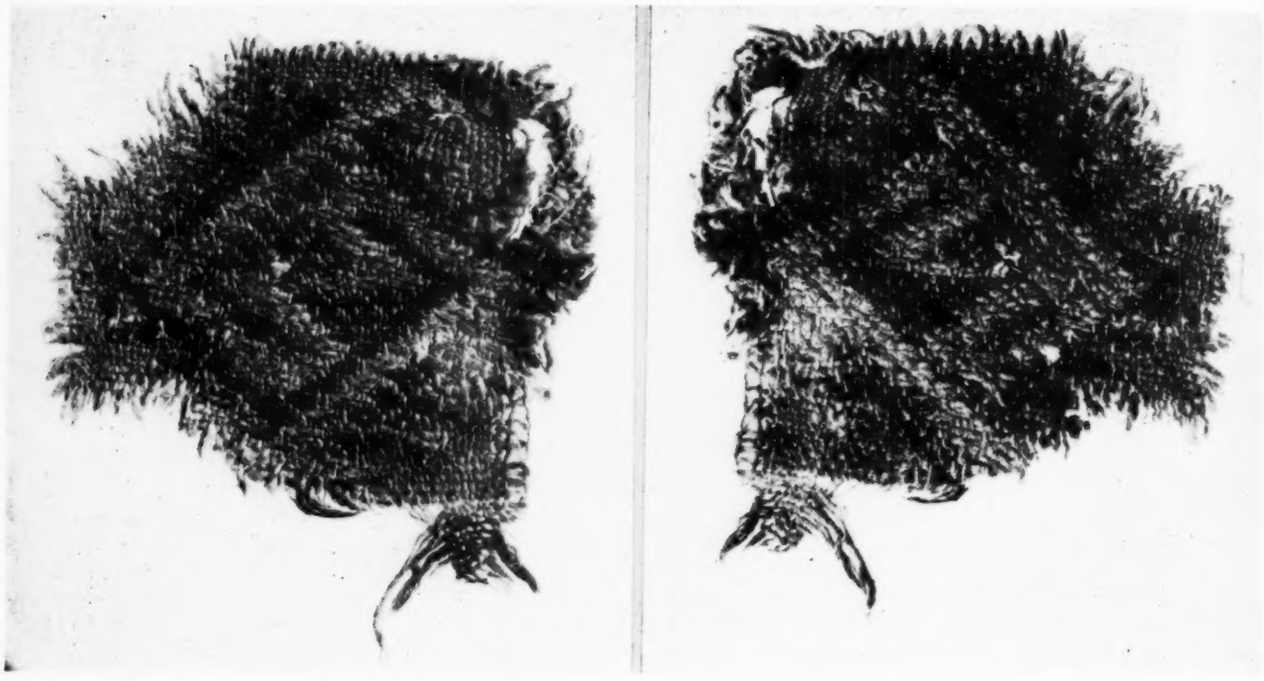
[101] Dr. Junius Bird, correspondence, June 1954.

[102] Reichard, 1936: 86.

FIG. 62. Patterns worked in diamond twill tapestry with interlocking wefts.

A. Four-thread diamond twill. Tularosa Cave. (Martin *et al.*, 1952: 299–300.) (1) The postulated heddle rig and interlocking technique employed in weaving the portion of the design included within the dotted rectangle in (2). Heddle 5 and the shed rod control warps for plain weave. (2) The design, consisting of a unit figure, or possibly a connected series of figures, set into a plain weave cloth.

B. A portion of the design in the diamond twill tapestry with interlocking wefts from Grand Gulch. (AMNH H/15982. See fig. 64.) The pattern has been ruled off so as to illustrate the manner in which it was built up from the small diamonds woven into the cloth.



A B

FIG. 63. Diamond twill tapestry with interlocking brown, blue, and white wefts used as an inset design (or possibly part of a fancy border) on a plain weave white cotton cloth fragment. Tularosa Cave. A. Surface of cloth. B. Reverse side of cloth, showing interlocking of wefts. (Photos by Chicago Natural History Museum.)

ing difference. The right side of the northern Arizona piece is definitely that surface on which long weft floats appear. Interlocking and knotting of brown and white wefts is done on the other surface, and here the wefts, crossing only one warp at a time, do not conceal warps completely, so that the design is not sharply defined (fig. 65, C). On the White House piece, right and wrong surfaces are reversed. Interlocking and knotting is done on the side with the *long* weft floats. So closely packed are the wefts that the side whereon they cross only *one* warp at a time looks like plain, over-one under-one tapestry weave (fig. 65, D). In other words, what appears to be the right side of the White House piece, is definitely the wrong side of the other. Since the over-one surface was almost certainly toward the White House weaver as he worked, the heddle rig would be exactly the opposite of that given for the northern Arizona twill. Those warps skipped by heddle one of the first piece would be clasped by heddle one of the second, and so on. Heddle rigs for the two pieces are:

Northern Arizona:

Shed rod:	– 2 – – – 6 – 8 – – – 12 – 14 – – –
Heddle 2:	– – 3 – 5 – – – 9 – 11 – – – 15 – 17
Heddle 1:	1 – – 4 – – 7 – – 10 – – 13 – – 16 –

White House:

Shed rod:	1 – 3, 4, 5 – 7 – 9, 10, 11 – 13 – 15, 16, 17
Heddle 2:	1, 2 – 4 – 6, 7, 8 – 10 – 12, 13, 14 – 16 –
Heddle 1:	– 2, 3 – 5, 6 – 8, 9 – 11, 12 – 14, 15 – 17

Thus the diagram of the right surface of the White House fragment (fig. 65, D) looks like the diagram of the underside of the northern Arizona piece (fig. 65, C). The former has a more open pattern of diamonds merely because of a different heddle rhythm. (The White House twill could have been woven with the same heddle rig as the northern Arizona cloth, if two heddles were pulled for each weft pick or if the weaver carried out the interlocking on the surface of the cloth. I assume that a separate heddle rig was used, since as we have said before this is the contemporary Indian way of setting up the loom for such twills.)

Both fabrics have simple designs in white on a dark field, woven by interlocking brown and white wefts. It is this design, and not the diamond pattern made by weft floats, that strikes the eye. Rigging the loom for diamond twill was merely a device to make possible the weaving of opposed diagonal lines while maintaining a regular heddle rhythm. Many tapestry patterns on twill cloth were woven on a loom rigged for plain twill, the opposed diagonal lines being created by pulling successively first one and then another heddle for a single weft pick (pp. 553–555). This involves a good deal of manipulation of heddles, and sometimes the pulling forward of certain warp groups by hand. It may have been a fairly slow process. A simpler and quicker means of weaving opposed diagonals is by rigging the loom for a diamond twill. In this way they are automatically produced, but will occur at *regular intervals*

across the web. The weaver must plan in advance a design which he can execute in accordance with the regular heddle order. The designs on these two cloths consist of white lines, two or three diamonds wide, slanting up to right or left along the obliques formed by the sides of the diamonds. The use of narrow white lines against broader areas of brown is suggestive of negative designing (p. 655). It is quite impossible to say whether the weaver thought of his pattern in terms of the brown forms, or of the white lines between them.

The White House diamond twill is part of an Anasazi plain twill cloth, with red, white, and brown wefts inserted in an over-one, under-two rhythm (p. 540). Probably the body of the cloth was plain twill and bands of diamond twill were woven along each warp edge. This is a custom very generally observed by contemporary Pueblo weavers in making dresses, shawls and some breech cloths. The heddles must be re-strung for the diamond twill areas.

The other fragment is one corner of a larger cloth, a warp and weft selvage still remaining. There is a band of plain weave in white between the warp selvage and the diamond twill. It is likely that the brown and white diamond twill was part of a decorative band along one end of a garment, and that the garment as a whole was plain weave. These two pieces should be compared with an Anasazi irregular twill tapestry also from Room 6, White House (fig. 67, A, p. 551), which has the same type of negative design arranged as a broad border along the warp edge of the cloth. Unfortunately none of these fragments has two complete weft edges. Were they originally kilts, breech cloths, or sashes with twill tapestry ends? Or mantas with a band of patterned twill along top and bottom edges like the historic Pueblo ones? There is some justification in assuming that they may have been decorative bands on fairly broad fabrics. The patterns are simple, with large solid areas of color. A wide space could be quickly and easily filled with such a design. In the case of the two diamond twills but one heddle was pulled for each pick of weft, which would further facilitate the weaving. (*See also* figs. 47, B and 79.)

Irregular twills.—The plain, reversed, diamond, and herringbone twills described above may all be thought of as "regular" twills, by which I mean that they were woven by pulling heddles in regular ascending or descending order, each heddle controlling one full pick of weft. We come now to a consideration of "irregular" twills. These fabrics show broken lines of ribbing produced either by an eccentric heddle order, or by the pulling of two or more heddles, successively, for a single pick of weft.

Twill woven with an eccentric, or broken, heddle order.—An excellent example of twill cloth woven with a broken heddle rhythm comes from Los Guanacos.[103] Though discolored, the cloth is believed to have been

[103] Haury, 1945*a*: 179, fig. 116.

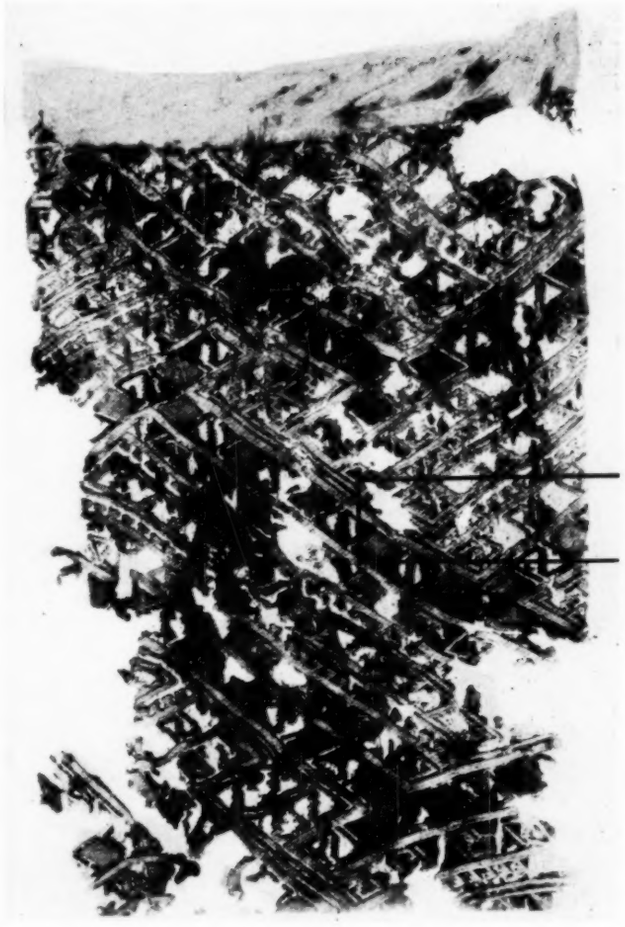


FIG. 64. Fragment of a blanket from Grand Gulch. Diamond twill tapestry with interlocking wefts. Width, 24". The distribution of diamonds in the boxed section is illustrated in fig. 62, B. (AMNH H/15982. Photo by American Museum of Natural History.)

brown and white. Brown threads are two-ply, S-twined. White threads are three-ply, Z-twined. Because of these multiple-ply threads, the piece has a coarse texture. In that part of the cloth which has been preserved, the warp is laid up so that two white threads alternate with two brown. Heddles were rigged for an over-two under-two twill (fig. 67, B, 1). Five picks of white weft alternate with five picks of brown. The white wefts were inserted with a regular heddle order starting with heddle 1, as follows:

H1, H2, H3, SR, H1

With the shift to brown wefts, the heddle rhythm breaks. Heddle 2 is passed over, and heddle 3 pulled instead. The heddle order for the brown wefts is:

H3, SR, H1, H2, H3

The shed rod is then skipped, breaking the rhythm again, and heddle 1 is pulled for the first white weft. White and brown weft bands alternate, each maintain-

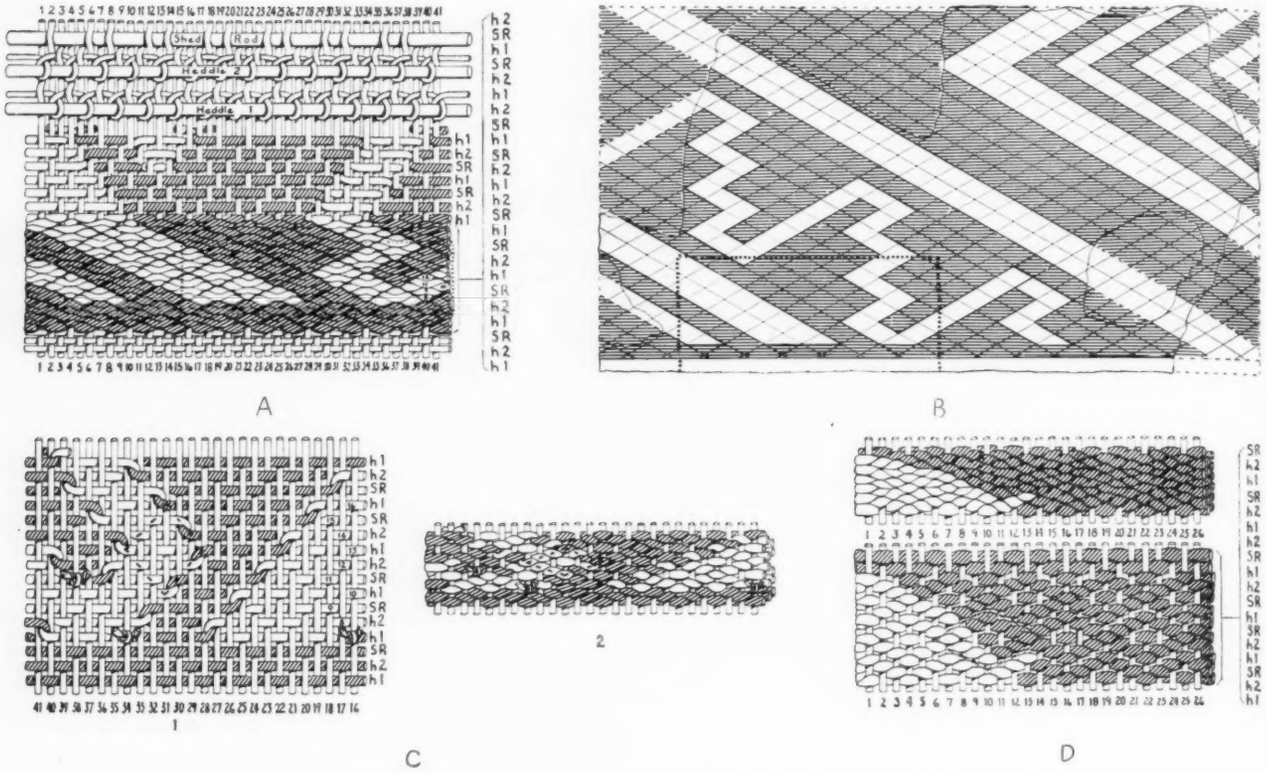


FIG. 65. Three-thread diamond twills, with interlocking brown and white wefts.

A, B, C. Design and construction details of a fragment from northern Arizona. (MNA 1233/A1481.)
B. Design, with reconstructed areas outlined and drawn with dashed lines. The pattern is blocked out in diamonds, each of which represents an actual woven diamond in the cloth itself. The dotted rectangle encloses the section of the weave illustrated in A.
A. Postulated heddle rig. The wefts in the lower portion of the drawing are shown forced close together as in the cloth itself. The heddle order for these wefts is given at the extreme right of the drawing. The underside of the section enclosed in the dotted rectangle is shown in C.
C. The underside of the cloth. (1) Wefts widely separated to clarify the technique. (2) The same section drawn with wefts close-battened as in the actual cloth. The same diamond is dotted in both C1 and C2.
D. Construction details of a fragment from White House. (AMNH 29.1/7679A.) This is shown both with wefts widely-spaced, and with wefts close-battened as in the cloth itself. The postulated heddle order is given at the extreme right.

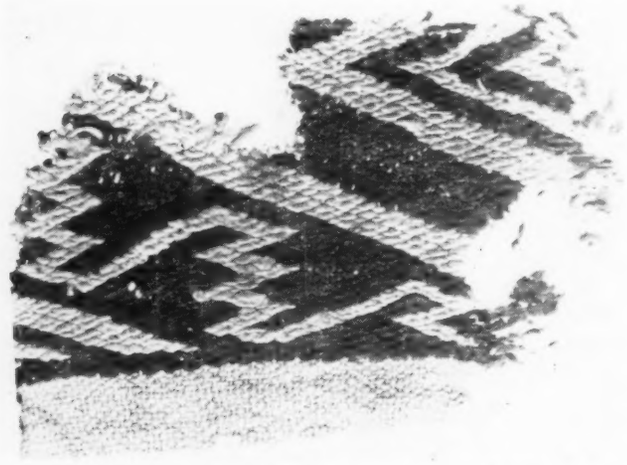


FIG. 66. Three-thread diamond twill with interlocking brown and white wefts. Probably the border of a plain weave white cloth. Northern Arizona. (MNA 1233/A1481. Photo by E. B. Sayles.)

ing its respective heddle rhythm:

White: H1, H2, H3, SR, H1
Brown: H3, SR, H1, H2, H3

The diagonal bands of ribbing are thus broken into segments.

The white warp pairs show as small unit figures in the brown weft bands, while brown warp pairs make similar figures in the white bands. The weaver thus cleverly planned his work so as to take advantage for purposes of design, not only of the warp and weft floats created by the irregular twill rhythm, but also of the contrasting brown and white threads. The fragment is really a plaid-patterned twill cloth. It is likely that, had more of the original piece survived, we would have seen a variation in the width of both warp and weft stripes.

Twills woven by successively pulling two or more heddles for each pick of weft.—There are two types of irregular twill cloth woven by pulling first one and then

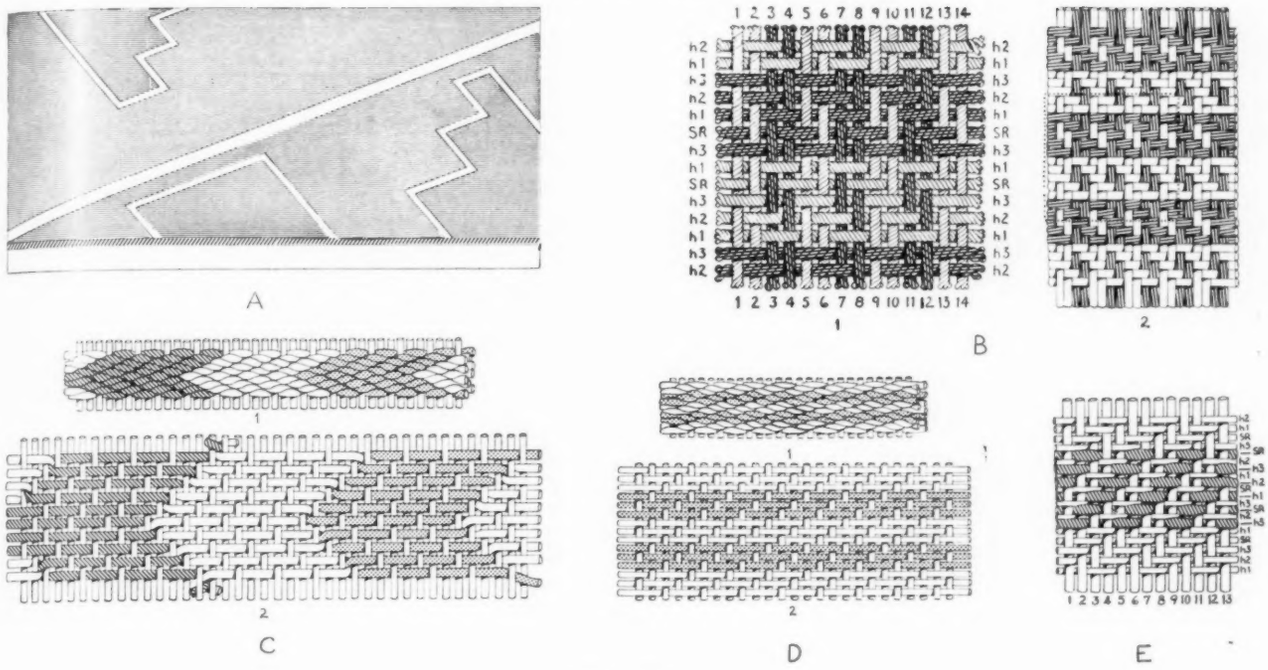


FIG. 67.

A. A negative design woven in irregular twill tapestry with black and white interlocked wefts. White House. (AMNH 29.1/7895C.)
B. Brown and white irregular twill plaid, woven with a broken heddle order. Los Guanacos. (Drawings based on Haury, 1945*a*: 179, fig. 116.) (1) Enlarged drawing of the weave showing postulated heddle rig for the section of the cloth enclosed by the dotted rectangle in (2), and the direction of twist and number of plies in warp and weft threads. (2) The design.
C. Method of interlocking wefts in twill tapestry weave. Threads are shown widely separated in (2) to clarify the usual interlocking technique. In (1) wefts are drawn close together as they appear in finished cloth.
D. "Beading" as accomplished with red and white wefts on Anasazi stripe fabrics. (1) The wefts shown close-battened so that they make a pattern of small red and white parallelograms. (2) The alternate weaving in of three red and three white wefts through which the beaded effect in the above drawing is achieved.
E. Twill with inlaid wefts, or brocaded twill. Kiet Siel. (MNA 695/NA2519.M347.)

another heddle for a single pick of weft. In the first type (*a*) one continuous weft thread passes from side to side of the web, as in plain weave or regular twill. In the second (*b*) a single weft pick may be composed of several different colored threads, interlocked or knotted where they meet, as in plain tapestry. This is "twill tapestry with interlocking wefts."

(*a*) Continuous weft thread. There are two good examples of the first type, one from Wupatki (MNA 627/NA405.M224(b)), and the other from White House (AMNH 29.1/7895B). That from Wupatki is a narrow scrap of cloth on which plain weave and over-two under-two twill are combined (figs. 58, A; 68, A). The original cloth must have been a plain weave handsomely patterned with bands of twill arranged in diagonal, zigzag, and diamond figures on its surface. To gain this effect it was necessary within any given weft pick to shift from plain weave to twill weave and back again. It is possible that the loom was strung with five heddles and a shed rod, four heddles controlling the twill, and the other heddle and shed rod governing plain weave. Or it may have been strung for one of the weaves (plain *or* twill, probably the latter since it is more complicated), while the second was picked in by hand without the aid of heddles.[104] Wefts pass under four warps at the edges of the twill bands, and the lines of long warp floats thus created serve to accentuate the shift from plain to twill weave.

A very simple modification of plain twill rhythm was employed in weaving the cloth from White House. The warps are finely spun single-ply white threads, the wefts rather coarse two-ply threads which may have been brown originally, or have been composed of one white and one brown ply. The loom was strung for over-two under-two twill, but heddles were so manipulated as to create a pattern of five parallel chevrons. In the technical drawing (fig. 68, B) these chevrons are shown with their center points at the right. Each is composed of four lines of floats. The spaces between are filled with diagonal ribs slanting the opposite direction from the chevron arms. This means that the lines of ribbing in the chevrons were made according to one heddle rhythm, while those of the "fill" required another

[104] The possibility must not be overlooked that the loom was rigged with only four heddles, and that pairs of heddles were pulled for the twill weave and other pairs for the plain weave. This, as we have remarked, would not seem to be within the Pueblo tradition as we observe it today.

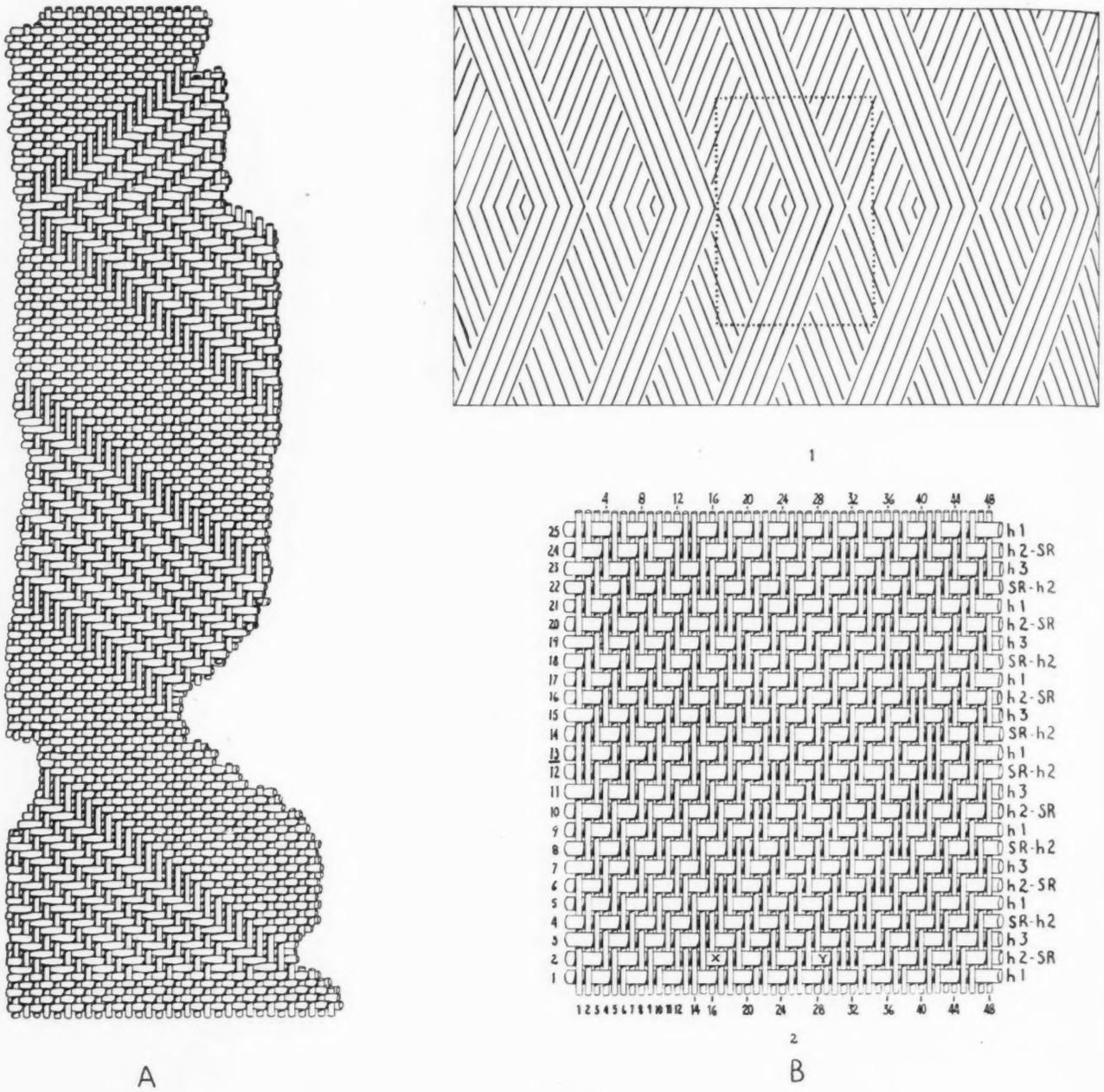


FIG. 68.

A. Plain weave and twill combined on a cloth from Wupatki. (MNA 627/NA405.M224(b).)
B. An irregular twill with continuous weft threads. White House. (AMNH 29.1/7895B.) (1) The pattern of chevrons made by twill diagonals. (2) The weaving of the section enclosed by dotted lines in drawing (1).

rhythm. In point of fact, this double rhythm was easily accomplished, as shown in figure 68, B, 2. Weft 1 was inserted the full width of the cloth with heddle 1 forward. Weft 2 was inserted with heddle 2 forward in the fill, thus starting a line of floats slanting up to the left. At warp 14, just left of what was to be a chevron (marked X–Y on the drawing), heddle 2 was dropped, and the shed rod brought into use. This forced the weft behind four warps in succession, and commenced a set of diagonals angling up to the right. At warp 32 just beyond the right edge of the chevron arm (*Y*) a return to heddle 2 was made. Weft 3 was inserted the full width of the cloth with heddle 3 forward. Weft 4 was inserted in the fill area with the shed rod forward, in the chevron arms with heddle 2 forward, and so forth. In brief, for every other weft row two heddles were employed. Thus two heddle rhythms were being maintained simultaneously, one controlling the lines of

floats in the fill and the other the lines of floats in the chevrons. The two rhythms are:

	Weft #1	Weft #2	Weft #3	Weft #4
For the fill:	H1	H2	H3	SR
For the chevron:	H1	SR	H3	H2

At weft 13 in the technical drawing the rhythms reverse, ribs of the fill being built up to the right and those of the chevrons up to the left. Heddle rhythms are thus:

	Weft #1	Weft #2	Weft #3	Weft #4
For the fill:	H1	SR	H3	H2
For the chevron:	H1	H2	H3	SR

The departure from regular plain twilling has resulted in a pleasing self-pattern. The cloth is 12½ inches wide, with both side selvages intact. Its original length is unknown. It may well have been a sash or breech cloth end.

(*b*) Irregular tapestry with interlocking wefts. Nine fragments may be classed as irregular twill tapestries with interlocking wefts.[105] They come from six sites. Three from White House (AMNH 29.1/7895A, D and 29.1/7896) are over-two under-one twills with red, white, and yellowish (probably faded from brown) wefts interlocked to make a pattern of zigzag lines similar to that of the regular reversed twill tapestry from Southwestern Colorado shown in figure 55. These may be parts of one cloth. A fragment from Mummy Cave (AMNH 29.1/1457) is the same type of twill with interlocked white and brownish-black wefts. A fifth piece, also from White House (AMNH 29.1/-

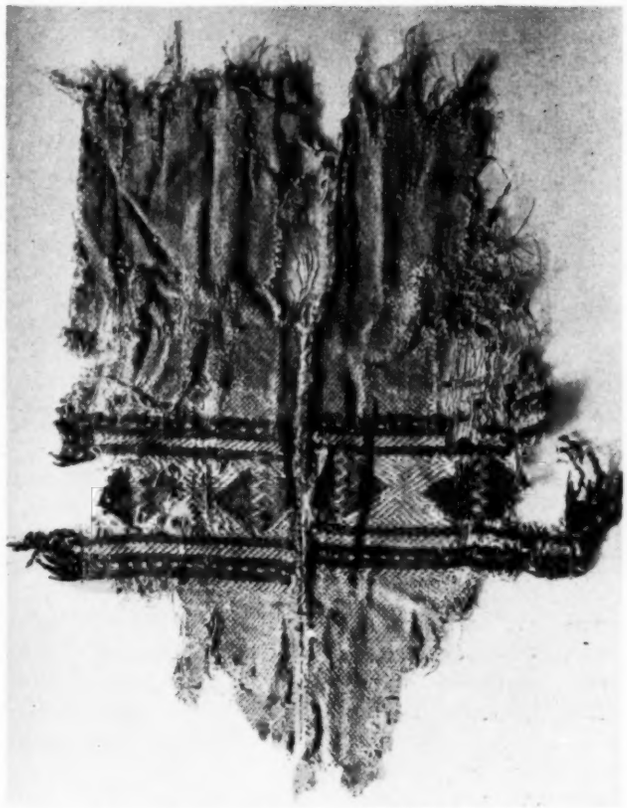


FIG. 69. A band of irregular interlocking twill tapestry in brown and white, applied to a plain weave cloth. Mesa Verde. (Photo by Museum of Northern Arizona from Nordenskiöld, 1893: pl. L.)

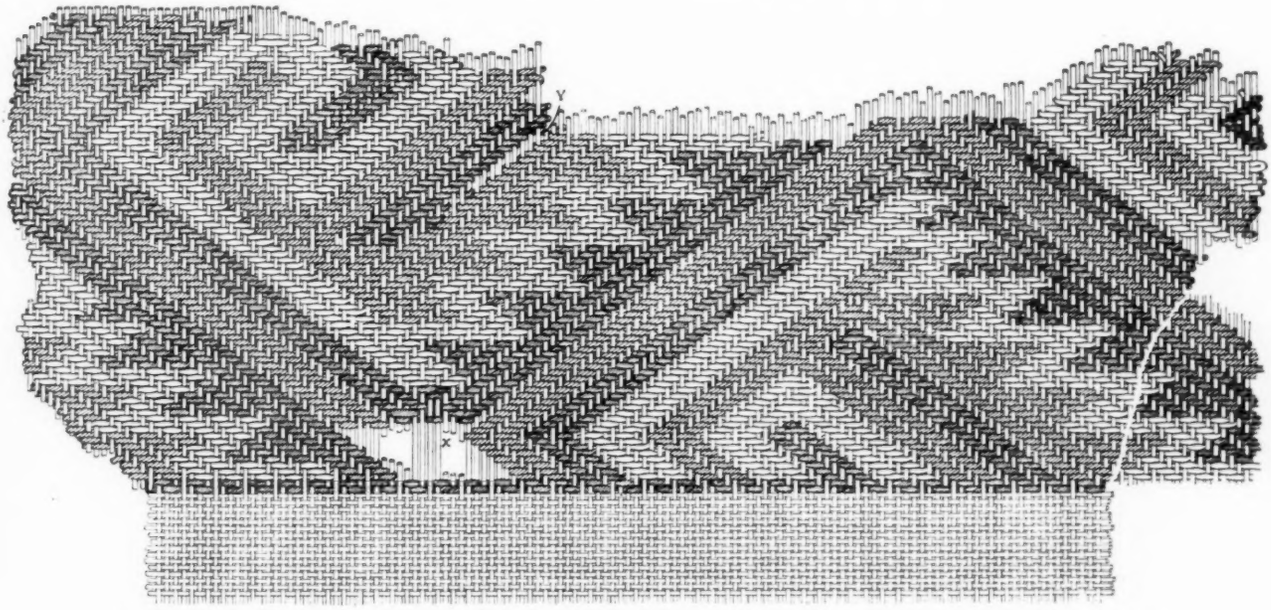


FIG. 70. Irregular twill tapestry with interlocking brown, blue, and white wefts. Probably the border of a plain weave cloth. Wupatki. (MNA 77/NA405.M233.)

[105] See Appendix C, chart 8, *a*: AMNH 29.1/1457, Mummy Cave. AMNH 29.1/7895 A, C, D and 29.1/7896, White House. ASM 20492, Hidden House. MNA 77/NA405.M233, Wupatki. NPS–T 9/483, Tonto Monument. Nordenskiöld, 1893, pl. L, Mesa Verde.

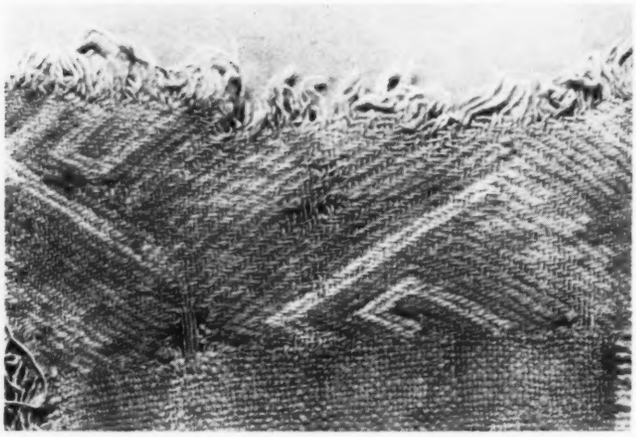
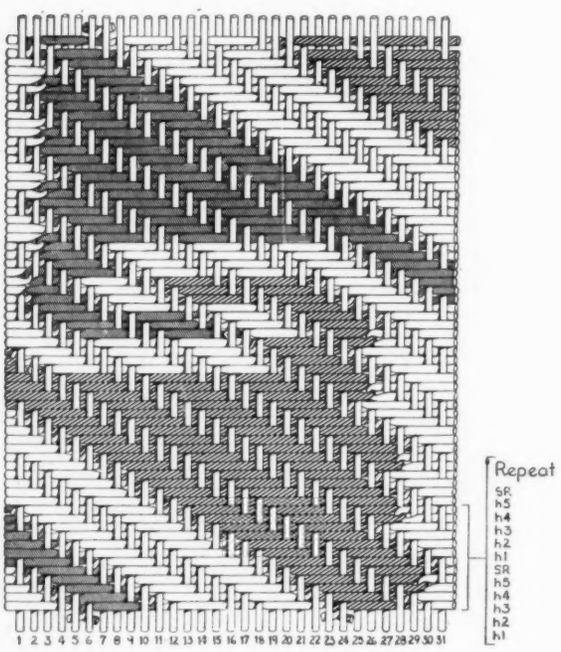
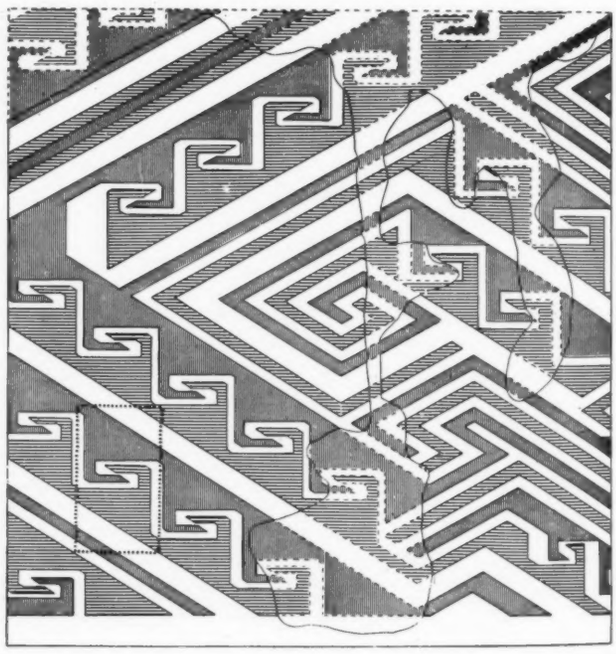


FIG. 71. An irregular twill tapestry with interlocking blue, brown, and white wefts. Wupatki. (MNA 77/NA405. M233. Photo by E. B. Sayles.)

7895C) and with the same twill rhythm, is a combination of plain Anasazi twill with brown, red, and white wefts and irregular twill tapestry with interlocked black and white wefts. The tapestry section forms a broad band inside the warp selvage of the cloth (fig. 67, A). The design is of narrow white lines against a solid black ground. It is very like patterns on the diamond twill tapestries described above (pp. 547–549). In this case the weaver chose to create his opposed diagonal lines in irregular twill rather than diamond twill, perhaps simply to save himself the task of re-stringing the heddles for the border.

I have no information on the piece from Mesa Verde other than Nordenskiöld's picture, reproduced in our figure 69.[106] This shows a plain weave cloth—or, rather, two fragments sewed together along their weft selvages—decorated with a band of fancy twill in brown and white. The technique in this band appears to be irregular twill tapestry with interlocked wefts. The designs on this and the remaining three irregular twill tapestries from Tonto, Wupatki, and Hidden House, are composed of small geometric color units combined into more or less complex over-all patterns, as in regular plain weave tapestries. In these, the distribution of twill diagonals is not itself important, but simply furnishes the weaver oblique lines along which to build his design in colored weftage. In some, the twill rhythm changes so frequently within a single weft pick that it seems the weaver was selecting warp sets by hand rather than relying on heddles. However, in my opinion the loom was rigged for twill so as to guide the worker, even though he might not adhere slavishly to the established rhythm.





A B

FIG. 72. The design and weave of a small quiver from Hidden House. (ASM 20492.)

A. The over-three under-three twill tapestry weave with interlocking black, brown and white wefts, as used in the section enclosed by dots in drawing B.
B. The design, with reconstructed portions outlined and drawn with dashed lines.

[106] Nordenskiöld, 1893: pl. L.

The twill border of a plain weave cloth from Wupatki (MNA 77/NA405.M233) has been reconstructed thread by thread in figure 70. It serves to illustrate how the weaver sometimes had to break the over-two under-two rhythm (as just above point *X*) in the interest of his design. These irregularities probably represent miscalculations on the weaver's part as he worked out, weft for weft, the pattern in his mind. Along the oblique marked *Y* the blue and brown wefts are separated by three warps instead of the established two, and are not interlocked. At the worn spot, *X*, there are not enough warps to allow for two ribs of the blue and two of the brown to extend to the edge, as seems to be required for a balanced design. There are indications that the present weft stretch of this piece, $7\frac{3}{8}$ inches, may be the original width of the cloth. If so we have here perhaps another decorated breech cloth front or sash.

The twilled breech cloth front from Tonto (NPS–T 9/483) is described on pages 609–613 with the discussion of breech cloths. Design units are brown, blue, and white (fig. 76, A). Finally, there is the twill cloth, evidently part of a small quiver, from Hidden House (ASM 20492) (fig. 72; 73; 74). The pattern of oblique lines and interlocking triangles with angled hooks is worked in brown, white, and black wefts. Wefts pass over-three under-three warps. Large blocks of the design could have been built with a particular heddle order. Figure 72, A illustrates the heddle rhythm used in weaving one pair of interlocking elements, for example. As we have seen, over-three under-three twill is not common. There are but two other examples—the reversed twill from Wupatki (pp. 540–543) and the six-thread diamond twill with interlocked wefts from Montezuma Castle (p. 545).

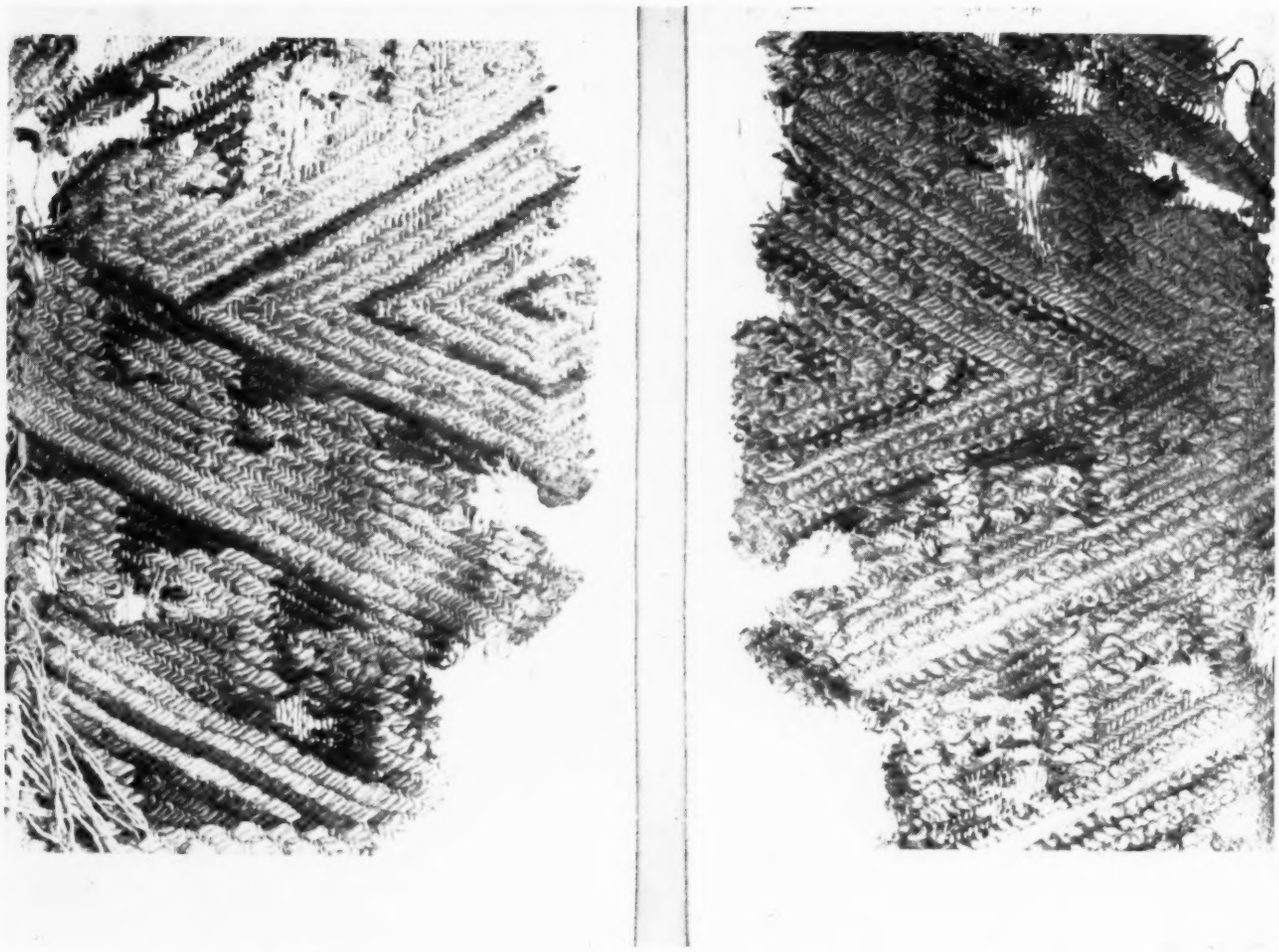
Double-weft Twill

Definition.—A form of twilling in which two wefts of contrasting colors are inserted in each shed. The first weft passes over every other set of depressed warps in the shed, and the second weft passes over the warp sets skipped by the first.

Technical description.—There is one excellent example (ASM 2983) of double-weft twill, the front section of a breech cloth, in near-perfect condition, from Gourd Cave (figs. 75; 115, B). Two heddles and a shed rod, rigged for over-two under-one plain twill, were used in weaving this cloth. At the beginning of the twill section, thirteen wefts were inserted—four brown, five white, four brown—in reversed twill. Then the double-weft twilling commenced, being executed in the same rhythm with blue and white wefts (with the exception of the first two courses of colored weft, which are brown).

The insertion of double wefts was probably done after the manner shown in figure 115, B, 4, as follows: at point *x*, with heddle 1 forward, a white weft was inserted and drawn over every other pair of depressed warps. Without changing the shed, a colored weft thread was then passed over the warp pairs skipped by the white weft. (Both these threads moved from left to right of the web.) Each thread thus actually floated over-two warps under-four warps, the action of the heddles being supplemented by a certain amount of finger manipulation. The two threads were closely

FIG. 73. A small cotton cloth quiver from Hidden House. The patterned section is woven in twill tapestry with interlocking brown, black, and white wefts. The toe of the quiver is a closed loop circular cloth. Length, $13\frac{3}{4}$". (ASM 20492. Photo by E. B. Sayles.)



A B

FIG. 74. The surface (A) and under side (B) of the interlocking twill tapestry cloth in the small quiver from Hidden House. (ASM 20492. Photos by E. B. Sayles.)

battened and caught in a single twist of selvage strings before returning through the web with heddle 2 forward. Because of the close battening each weft pick appears to consist of alternate brown or blue and white floats, each two warps wide. The over-all pattern is of vertical blue and white zigzag lines. Points *y* and *z* show where new wefts have been tied in.

Twill with Inlaid Wefts, or Brocaded Twill

Definition.—A regular twill in which the pattern is accentuated by laying in non-structural wefts of a contrasting color between regular weft picks. Each laid-in weft passes *over* the warp sets skipped by the regular weft immediately preceding it.

Technical description.—The technique about to be described may be thought of as "brocaded twill," with one important proviso. In brocade, as we have defined it (p. 655), the non-structural wefts are used to *create* a pattern of their own on a plain surface. The brown wefts in the piece under discussion here do not create their own design, but merely accentuate the twill pattern woven by the basic white wefts (fig. 67, E).

Recognition of twilling with inlaid wefts depends, unfortunately, on one small fragment from Kiet Siel (MNA 695/NA2519.M347). The rhythm is over-two under-two, but I was unable to determine whether the loom was strung for plain or diamond twill. At some points the spaces left by regular twilling, which would normally appear as lines of warps, are filled in with brown wefts. Here the cloth feels thicker than in adjoining sections.

The effect is like that of double-weft twill, but the weaving method is not the same. In double-weft twill, if our analysis is correct, two wefts were actually shot through each time a heddle was raised. This is not true of the Kiet Siel fragment. In weaving this, heddle 1 was first raised, pulling forward warps 1, 2 – – 5, 6 – – 9, 10 – – etc. A white weft was drawn through this shed. Next a brown weft was laid in, crossing *over* the warp pairs skipped by the white. And so the weave proceeded, with white and brown wefts alternating. Probably brown wefts were drawn in by hand after each white pick in the manner of brocade. However, heddles may have been pulled for both brown and white wefts,

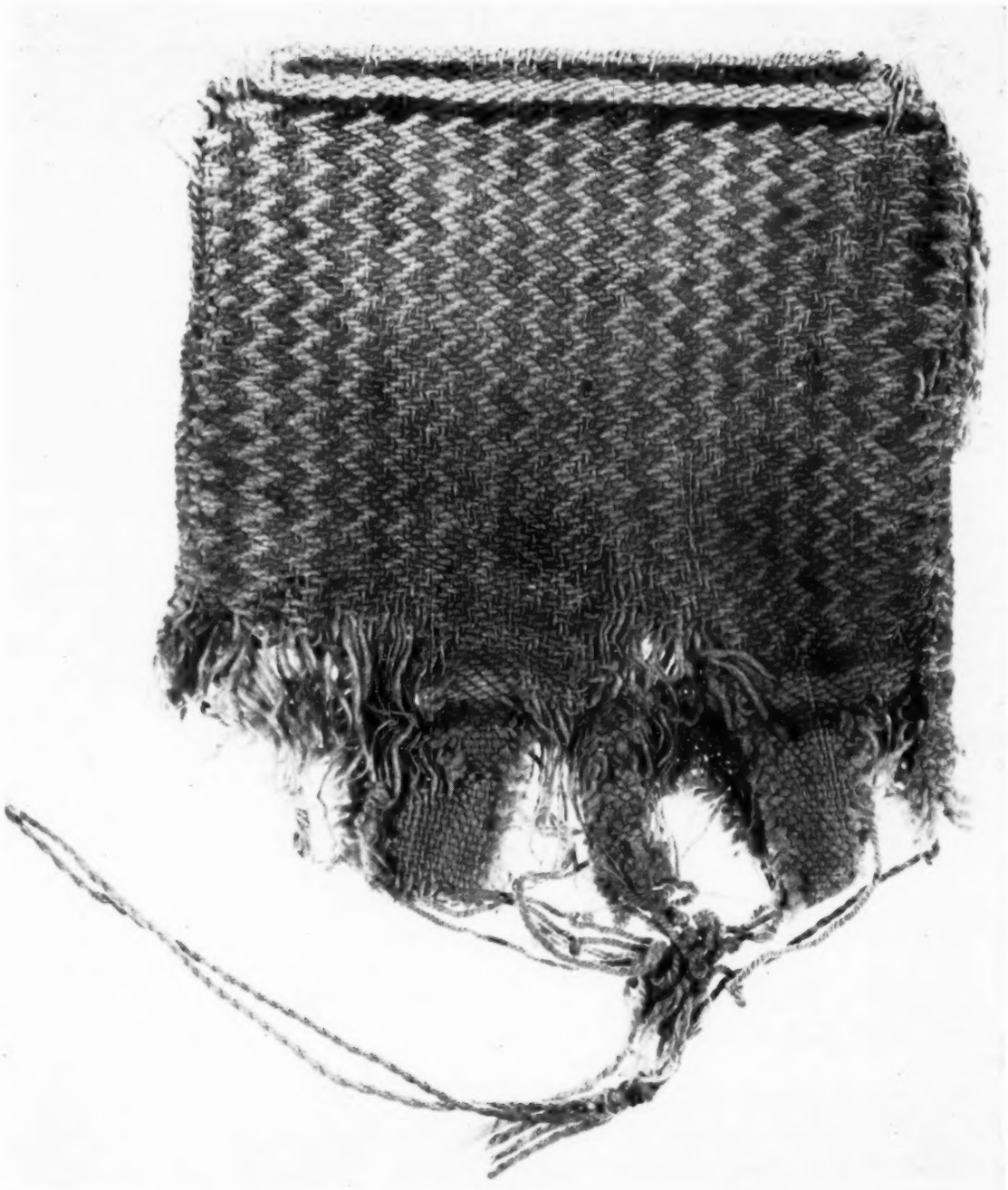


FIG. 75. A breech cloth from Gourd Cave, woven in double-weft twill with blue, white, and some brown wefts. Width, $6\frac{3}{8}$". (ASM 2983. Photo by E. B. Sayles.)

so that a sort of double heddle order was maintained, as follows (brown weft floats underscored):

Br Heddle 2:	– 2, 3 – – 6, 7 – – 10, 11 –
W Shed rod:	1 – – 4, 5 – – 8, 9 – – 12
Br Heddle 1:	1, 2 – – 5, 6 – – 9, 10 – –
W Heddle 3:	– – 3, 4 – – 7, 8 – – 11, 12
Br Shed rod:	1 – – 4, 5 – – 8, 9 – – 12
W Heddle 2:	– 2, 3 – – 6, 7 – – 10, 11 –
Br Heddle 3:	– – 3, 4 – – 7, 8 – – 11, 12
W Heddle 1:	1, 2 – – 5, 6 – – 9, 10 – –

In my opinion, if more of the cloth remained we would find it a brocade, with brown threads drawn in when wanted—perhaps to emphasize completed diamonds, if this were a diamond twill—and floated on the underside when not needed for designing. There is the strong possibility that the brown and white fragments from Tonto described on pages 531–532 as warp-float pattern weave, may rather be brocaded twill or brocaded weft-float. The patterned center of the twill cloth from

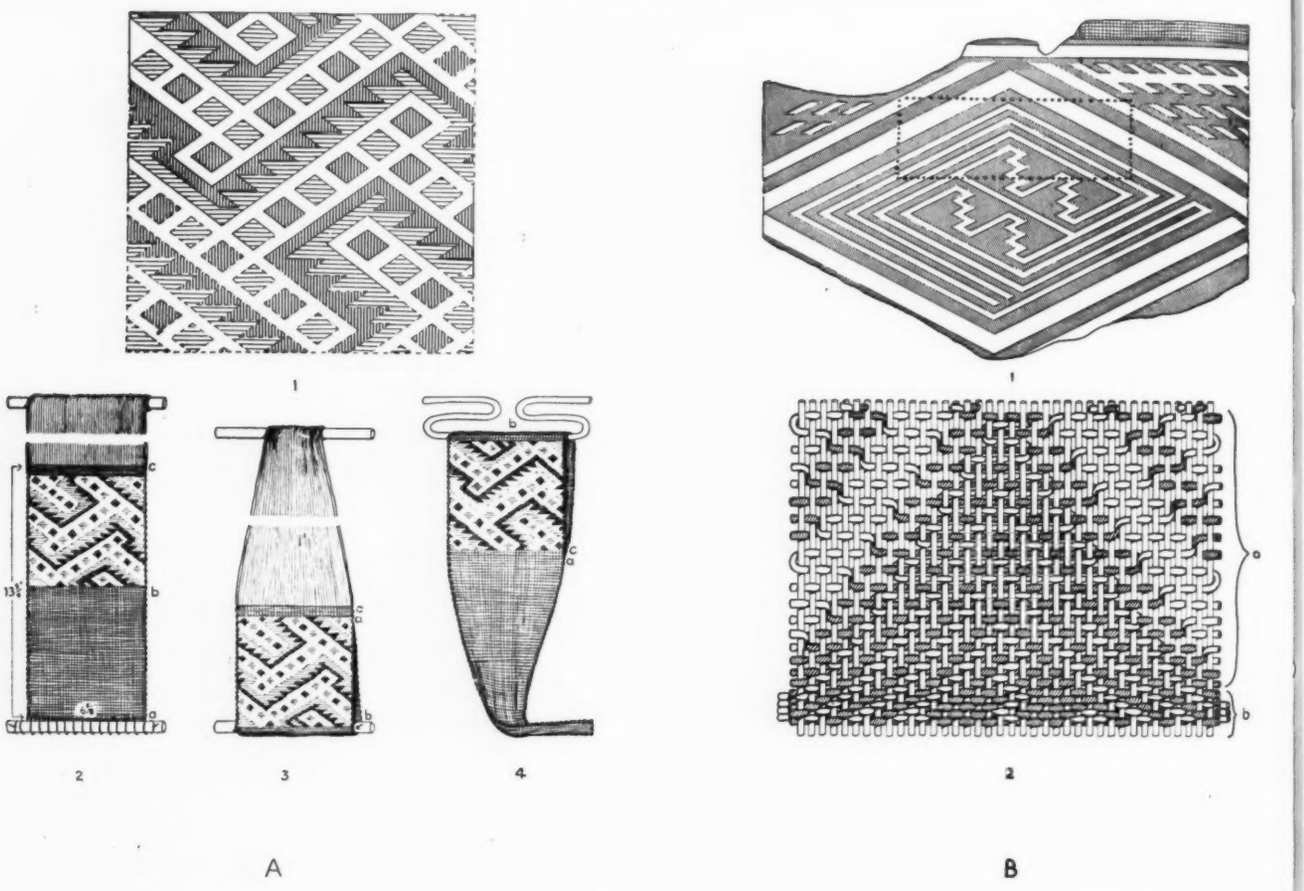


FIG. 76.

A. A breech cloth from Tonto. (NPS-T 9/483.) (1) The front of the cloth, patterned in irregular twill tapestry with interlocking brown, blue and white wefts. (2) The position of the cloth on the loom, showing how first a section of plain weave, and then the twill, were woven. (3) The plain weave portion, detached from the lower loom bar, folded over it, and joined to the patterned front. (4) The completed breech cloth, with waist band in place.

B. Tapestry weave breech cloth with brocaded weft-float center design. Black and white wefts. White House. (BM 03.250-6.) (1) The design. (2) The weave, as used in the section outlined by dotted lines in (1). (*a*) The wefts well separated to clarify technique. (*b*) Wefts drawn close together as in the actual cloth.

Kiet Siel described on page 561 as a brocaded weft-float weave, may also have been brocaded twill.

2. *Weft-Float Pattern Weaves*

The following discussion includes two types of cloth: first, the regular weft-float pattern weaves; and second, weft-float pattern weave with brocade wefts.

Weft-float Pattern Weave

Definition.—A weave in which the pattern is built up by floating wefts freely over and under groups of warps not governed by heddles, but selected by hand.

Technical description.—Building a design of weft floats is a comparatively simple process. No heddles are used. Instead, the weaver selects certain warps by hand and holds them forward with his fingers, or with the batten or a small stick, while he inserts the weft. He repeats this for each pick of weft, planning the lines of floats so that they fall into geometric patterns. This is like brocading, except that there is no separate set of wefts maintaining a plain or twill rhythm. Design and construction wefts are one and the same.

Despite the technical simplicity of weft-float pattern weave there are but two really good examples of it, both from Montezuma Castle. A third fragment comes from White House, and there is a piece, doubtfully included in the classification, from Lenaki.[107]

The cloth from White House is really a scrap of plain weave white cotton, with a decorative band of three floated wefts. Two-ply threads, these contrast with the regular single-ply wefts. A portion of warp selvage remains. Two wefts in from this is a row of twine-stitching. Then come three plain weave wefts, three floated wefts, three plain weave wefts, and another row of twine-stitching (fig. 32, A). The first and third

[107] See Appendix C, chart 8, *a* and *b*: AMNH 29.1/7897D, White House. MNA 712/NA2630 R3.7b, Lenaki. NPS-MC 18, 33, Montezuma Castle.

decorative wefts float over-three warps, under-one, over-one, under-one, and repeat. The second weft floats under-three, over-one, under-one, over-one and repeat. This is shown in the following diagram, with depressed warps represented by dashes:

Weft 3: – – – 4 – 6 – – – 10 – 12 – – –
Weft 2: 1, 2, 3 – 5 – 7, 8, 9 – 11 – 13, 14, 15
Weft 1: – – – 4 – 6 – – – 10 – 12 – – –

The piece is not a typical weft-float, as heddles may have been used in inserting the three wefts. Wefts 1 and 3 could have been woven in with the heddle controlling even-numbered warps pulled forward, by being floated over warps 2, 8, 14, etc., instead of passed behind all even-numbered warps, as would be the case in regular plain weave. For number 2 the shed rod could have been pulled, forcing forward the odd-numbered warps, and the weft drawn in behind them and also behind warps 2, 8, 14, etc.

The small fragment from Lenaki resembles an Anasazi twill in that there are white, black, and red weft stripes. Figure 32, C shows the heddle rig and rhythm which *may* have been used in weaving it. Near the top of the drawing, however, there will be seen three wefts (*x*, *y* and *z*) which were inserted in a manner completely unrelated to this postulated heddle rig. These irregularities are either due to mistakes in weaving, or the cloth was woven as a weft-float pattern weave. It is quite impossible to say which is the case on the basis of so small a piece.

FIG. 77. Weft-float pattern weave in black and white, folded and sewed to form a small bag $5\frac{3}{4}$″ wide. Montezuma Castle. (NPS–MC 18. Photo by Denver Art Museum.)

FIG. 78. The Montezuma Castle weft-float pattern weave bag opened out. Length, 25″. Photo on left shows pattern on inside of bag, presumably the undersurface of the textile. (NPS–MC 18. Photos by Denver Art Museum.)

The Montezuma Castle weft-floats are remarkable for the complexity of their geometric designs. These are executed in black wefts on white warps. One (NPS–MC 18) is a bag fashioned from a narrow textile, 25 inches long and $5\frac{3}{4}$ inches wide, folded at its center and sewed up the sides with running stitches (figs. 32, B; 77; 78). Weft threads are paired. They are floated over the warps in a rhythm much like twilling, for the most part, but with many irregularities within each weft pick. Black and white are evenly

FIG. 79. The front of a breech cloth from White House. Plain weave tapestry with a brocaded weft-float center pattern. Black and white wefts. Width, 5½". (BM 03.250–6. Photo by Brooklyn Museum.)

balanced in the completed design. The over-all pattern is of the type that could be extended indefinitely beyond the edges of the cloth (p. 628). The second Montezuma Castle piece resembles this, but has single wefts.

Brocaded Weft-float Pattern Weave

Definition.—A design made by weft-floating may be accentuated by laying in threads of a contrasting color, or brocade wefts. These are brought to the surface when the structural wefts are floating on the underside of the cloth, and *vice versa*.

Technical description.—There are two, or possibly three, examples of brocaded weft-float.[108] One is a plain tapestry weave with brocaded weft-float center design, and the other two are twill weave cloths with brocaded weft-float centers.

(*a*) Plain tapestry weave breech cloth with center design in brocaded weft-float pattern weave. The front of a breech cloth from White House (BM 03.250–6), handsomely patterned in black and white, is woven partially in regular interlocking plain weave tapestry, and partially in weft-float pattern weave with brocade wefts. (For the construction of the piece as a breech cloth consult page 613.)

The reader should refer to figures 79 and 80, showing the surface and reverse sides of the cloth, and to figure 76, B, in order to comprehend the following discussion. It will be seen that the design is centered in a diamond area outlined by broad lines of white. The central pattern of interlocking double keys in black, and the narrow black and white lines framing it, with the exception of those along the lower right edge of the diamond, contain two wefts to every one used in the broad outer lines of the diamond. The cloth feels of double thickness here. The broad lines are woven in the familiar plain tapestry technique with interlocking wefts. The inner pattern is carried out in a quite different fashion. Here the black wefts pass regularly over-one under-three warps as in twilling, except in the central keys, where they are brought to the surface or floated underneath according to the dictates of the design. Each white brocade weft also passes regularly over-one under-three warps, crossing over the middle one of the three warps skipped by the preceding black weft. No weft, black or white, ever floats *over* more than one warp on the surface of the cloth, but there are long floats of white and some black on the underside of the cloth in the patterned center of the diamond. These floats, and the hooking in of white wefts for the center of the diamond may be clearly seen in figure 80. The small white units at the upper corners of the cloth are also done in this weft-float technique with brocade wefts.

This weave was duplicated experimentally in the following manner. With heddle or shed rod forward a black weft was passed over every other one of the depressed warps, and a white weft inserted in the same shed over alternative warps. Or, the black weft crossed warps 1, 5, 9, etc., and the white warps 3, 7, 11, etc. This is the same process followed in double-weft twilling (pp. 555–556) except that the loom is strung for plain weave. At some points this rhythm was broken. For example, in weaving the center keys black wefts pass over-one under-one as in regular plain tapestry weave, and white wefts form long floats on the under surface.

(*b*) Twill cloths with center designs in brocaded weft-float pattern weave. A rectangular cloth from Grand Gulch, sewed to form a crude bag, is our second example of brocaded weft-float (AMNH H/14400; fig. 97, A). The cloth is about 13¼ inches square, with plain weave borders in white, 2 to 2½ inches wide, at top and bottom edges. Within these borders, the weave is an over-two under-one twill tapestry. The twill section is delineated by narrow black weft stripes, each three weft picks wide, separating it from the plain weave borders. A black and white diamond, measuring about 7 inches on each side, is centered on the white cloth be-

[108] See Appendix C, chart 8, *a* and *b*: AMNH H/14400, Grand Gulch. BM 03.250–6, White House. MNA 695/NA2519.M337, Kiet Siel.

tween these weft stripes. Within the diamond there are two wefts for every one in the surrounding field. Here the piece is so badly worn that the pattern cannot be distinguished. From what remains we judge there were triangles, or points, of black along the edges of the diamond. The points are woven of black wefts interlocked with the white of the background. These wefts must have passed from edge to edge of the diamond, creating a pattern similar to that on the breech cloth just described. On the undersurface of the cloth one may distinguish white wefts hooked in over the black along the inner edges of the triangles, so that every other weft is white. These white threads probably passed from edge to edge of the diamond within the stepped points, acting as brocade wefts. Where both black and white wefts remain, one sees them passing over-two under-four warps as in double-weft twilling. It is likely that if the wefts were not so badly worn out of this center section, we would find the regular rhythm broken in places in the interests of design. In other words, we should see weft-floating. Hence, although the weave of the ground cloth is twill, the center pattern is woven in a brocaded weft-float technique such as that seen on the breech cloth from White House.

FIG. 80. The reverse side of the breech cloth shown in the preceding figure. The floating of black and white wefts, and the hooking in of brocade wefts for the center design may be clearly seen. (BM 03.250–6. Photo by Brooklyn Museum.)

In both pieces, white wefts are hooked into the pattern area when needed.

An over-two under-two twill cloth from Kiet Siel (MNA 695/NA2519.M337) is doubtfully included in this section. The piece has a complete warp stretch of nine inches. At the present time it is only three inches wide. At top and bottom edges are plain weave borders about one and a half inches wide, which are separated from the twilled center of the cloth by narrow brown weft stripes. The twilling as a whole is done with white wefts, but there are indications that a weft-float pattern was woven at the center of the cloth in brown wefts. The cloth is so similar in many respects to that from Grand Gulch described above, that I have considered it an example of the same technique.

In addition to the floated weaves described in this section of the text, there are certain small finger-weave articles patterned in weft-float or twill designs. These include miniature sacred cigaret "blankets" or "sashes" (pp. 620–621) and small tubular weave sacks (pp. 583–586).

The Uses of Floated Weave Cloth

Weaving a regular twill with non-interlocked wefts is as simple a process as plain weave after the initial stringing of the heddles has been accomplished. It is merely a matter of pulling a heddle and shooting a pick of weft through the shed. One must keep the heddle order in mind, but aside from that, the process is quite mechanical. Because of this, twill weave is well suited for weaving wide fabrics. An incomplete cloth, 32½ by 20⅜ inches, from Aztec, and a 20-inch wide fragment from Canyon de Chelly, both Anasazi stripe cloths, show that twilling was so used in the Anasazi area at least. I think it likely that striped twill cloth was a standard weave for blankets in that region.

For the most part, weft-float pattern weave, complex twills and twills with interlocked wefts had a more limited use. The great exception is, of course, the large blanket from Grand Gulch. Generally, these techniques were applied to narrow cloths, or border panels or center unit designs on plain weave or regular twill fabrics. There are fifteen narrow textiles between about five and thirteen inches wide. Nine may be identified to use as follows: five breech cloth fronts, two bags, one knife case and one quiver. The uses of the remaining six are not so obvious. Two were apparently fringed along at least one warp selvage. They may be sash ends, breech cloth fronts, or small bags. Four twill tapestries with interlocked wefts are border panels—two on Anasazi stripe cloths and two on white plain weaves. Brocaded weft-float appears in two instances as center unit designs on small, rectangular twill weave cloths. The diamond twill tapestry from Tularosa Cave appears to be either an isolated design or part of a border panel on a plain weave cloth (see table 4).

TABLE 4

THE USES OF FLOATED WEAVE

1. *Large Cloths*

Cat. No. or Ref.	Provenience	Technique and Pattern	Article
AMNH H/15982	Grand Gulch	Diamond twill tapestry with interlocked wefts.	Blanket.
BM 12653	Canyon de Chelly	Reversed twill, Anasazi stripe.	Blanket fragment (?)
NPS-AM 954 & 4000	Aztec Monument	Reversed twill, Anasazi stripe.	Blanket or poncho.
2. Original Size Unknown, Use as Border Design Apparent			
AMNH 29.1/7679A	White House	Diamond twill, interlocked wefts, negative pattern of white lines on brown ground.	Border of Anasazi stripe twill cloth.
AMNH 29.1/7895C	White House	Irregular twill tapestry, interlocked wefts, negative pattern of white lines on a black ground.	Border of Anasazi stripe twill cloth.
MNA 1233/A1481	Unknown	Diamond twill, interlocked wefts, negative pattern of white lines on brown ground.	Border of plain weave white cloth.
Nordenskiöld, 1893: pl. L	Mesa Verde	Irregular twill tapestry, interlocked wefts. Brown and white design units.	Narrow border on plain weave white cloth.
3. Original Size Unknown, Unit or Border Design on Plain Weave Cloth			
Martin *et al.*, 1952: 299–300	Tularosa Cave	Diamond twill, interlocked wefts. Blue, brown and white unit design.	Either unit design on plain weave cloth, or one of a series of units forming border of cloth.
4. Small Cloths (Breech Cloths, Knife Cases, Bags, Quivers and Possibly Sashes)			
AMNH 29.1/7710	White House	Reversed twill, self-pattern.	Breech cloth.
AMNH 29.1/7895B	White House	Irregular twill, continuous weft thread, self-pattern.	12½″ complete width.
AMNH H/14400	Grand Gulch	Brocaded weft-float pattern weave, center design on rectangular cloth.	Bag made from 13¼″ square cloth.
ASM 20492	Hidden House	Irregular twill tapestry, interlocked wefts. Brown, black and white design units.	Quiver.
ASM 2983	Gourd Cave	Double-weft twill.	Breech cloth.
BM 03.250–6	Canyon de Chelly	Brocaded weft-float pattern weave.	Breech cloth.
MNA 77/NA405.M233	Wupatki	Irregular twill tapestry, interlocked wefts. Brown, white and blue design units.	Border on plain weave cloth 7⅝″ wide.
MNA 77/405.M235	Wupatki	Reversed twill, self-pattern with brown wefts.	6″ complete width. Plain weave border and fringe.
MNA 695/NA2519.M337	Kiet Siel	Brocaded weft-float pattern weave, center design on small cloth.	9″ complete warp stretch.
CSHS 01461	Mesa Verde	Reversed twill, Anasazi stripe.	6½″ wide, narrowing to 4½″ at warp selvage. Breech cloth.
CU, no number	Aztec	Reversed twill, Anasazi stripe.	8½″ complete width. Fringe along warp selvage.

TABLE 4—*Continued*

Cat. No. or Ref.	Provenience	Technique and Pattern	Article
NPS-MC 18	Montezuma Castle	Weft-float pattern weave.	Bag, made from cloth 25" × 5¾".
NPS-T 9/483	Tonto	Irregular twill tapestry, interlocked wefts. Brown, blue and white design units.	Breech cloth.
UM 29.43.112	Southwestern Colorado	Reversed twill tapestry, interlocked wefts. "Lightning' pattern.	10½" complete width.
UM 29.45.153	Southwestern Colorado	Reversed twill, Anasazi stripe.	Knife case, made from cloth 6½" wide.

Designs on Floated Weave Cloths

Weft-float Designs

The Montezuma Castle weft-floats with their complex all-over geometric designs worked in black and white, are reminiscent of brocaded plain weave cloth. Brocaded twills and weft-floats are also patterned in brown or black and white. Designs in weft-float on the Canyon de Chelly breech cloth and on the rectangular twilled cloths from Grand Gulch and Kiet Siel take the form of unit patterns centered within a well defined diamond-shaped area. Other examples of weft-float are too fragmentary to show design.

Twill Weave Designs

Twill fabrics, on the basis of design, fall into four general classes, as follows:

Self-patterned twills, or those in which the pattern effect depends solely on the arrangement of twill ribs. This would include such pieces as the reversed twill breech cloth (fig. 116, B) and the chevron-patterned fabric from White House (fig. 68, B), and the plain weave-plus-twill cloth from Wupatki (fig. 68, A).[109]

Tapestry-patterned twills, or cloths in which small colored design elements are combined to form a complex over-all pattern.—Most of the twill tapestries with interlocked wefts belong in this class. The patterns are like those woven in plain tapestry. Twill diagonals or diamonds are not in themselves important, but simply furnish convenient oblique lines along which the design may be built. Examples include: the blanket from Grand Gulch (figs. 62, B; 64), the breech cloth from Tonto (fig. 76, A), the small quiver from Hidden House (figs. 72, 73, 74), the Tularosa Cave fragment (figs. 62, A; 63), and the piece from Wupatki (figs. 70; 71).[110]

Twills patterned by "negative" designs of narrow, white lines on a dark ground.—There are three of these, two from White House and one from an unknown site (figs. 65, 66, 67, A). Here, again, the twill diagonals are not important except as a means to an end. All the pieces are twill tapestries with interlocked wefts. They are technically identical to those included in the above classification, but are distinguished from them on the basis of design.[111]

Cloths in which twill ribs and colored warp or weft threads combine to form the pattern.—In these cloths diagonals and colored threads are of equal importance to the design. Examples are the reversed twill tapestry with interlocked wefts from Southwestern Colorado (fig. 55), the double-weft twill from Gourd Cave (figs. 75; 115, B), the diamond twill from Montezuma Castle (figs. 59, B; 61), and the irregular twill "plaid" from Los Guanacos (fig. 67, B).[112] The distinctive *Anasazi twills* belong also to this class.

Anasazi twills have been referred to repeatedly in the text. Nearly half of the twill cloths studied fall into this group. They are characterized by brown or black, red and white weft stripes (see figs. 56, 60, 81). These may be solid bands of color in various widths, or narrow beaded lines. Beading in textiles does *not* refer to the sewing of beads to the cloth. It is the term applied to narrow decorative rows made up of tiny blocks in alternating colors. In this case, the beading was done by weaving in alternately three picks of white and three of red. The wefts used were generally very fine-spun like warp threads, rather than soft and thick like ordinary weftage. Picks were beaten so closely together that the effect is of tiny parallelograms ("beads") of white and red arranged checkerboard fashion (fig. 67, D).

The effectiveness of an Anasazi twill pattern depends upon the skill with which red, white, black and beaded bands are combined. Various combinations are shown in figure 81. It will be seen that beaded lines are woven between broader bands of solid red. Wide black or brown bands are often flanked by narrower red and white stripes. The weave is usually varied somehow

[109] See Appendix C, chart 8, *a*: AMNH 29.1/7710, White House. AMNH 29.1/7895B, White House. MNA 627/405.M224 (*b*), Wupatki.

[110] See Appendix C, chart 8, *a*: AMNH H/15982, Grand Gulch. ASM 20492, Hidden House. Martin *et al.*, 1952: 299, Tularosa Cave. MNA 77/NA405.M233, Wupatki. NPS-T 9/483, Tonto.

[111] AMNH 29.1/7679A and 29.1/7895C, White House. MNA 1233/A1481, site unknown.

[112] See Appendix, chart 8, *a*: ASM 2983, Gourd Cave. Haury, 1945*a*: 179, Los Guanacos. NPS-MC 56, Montezuma Castle. UM 29.43.112, Southwestern Colorado.

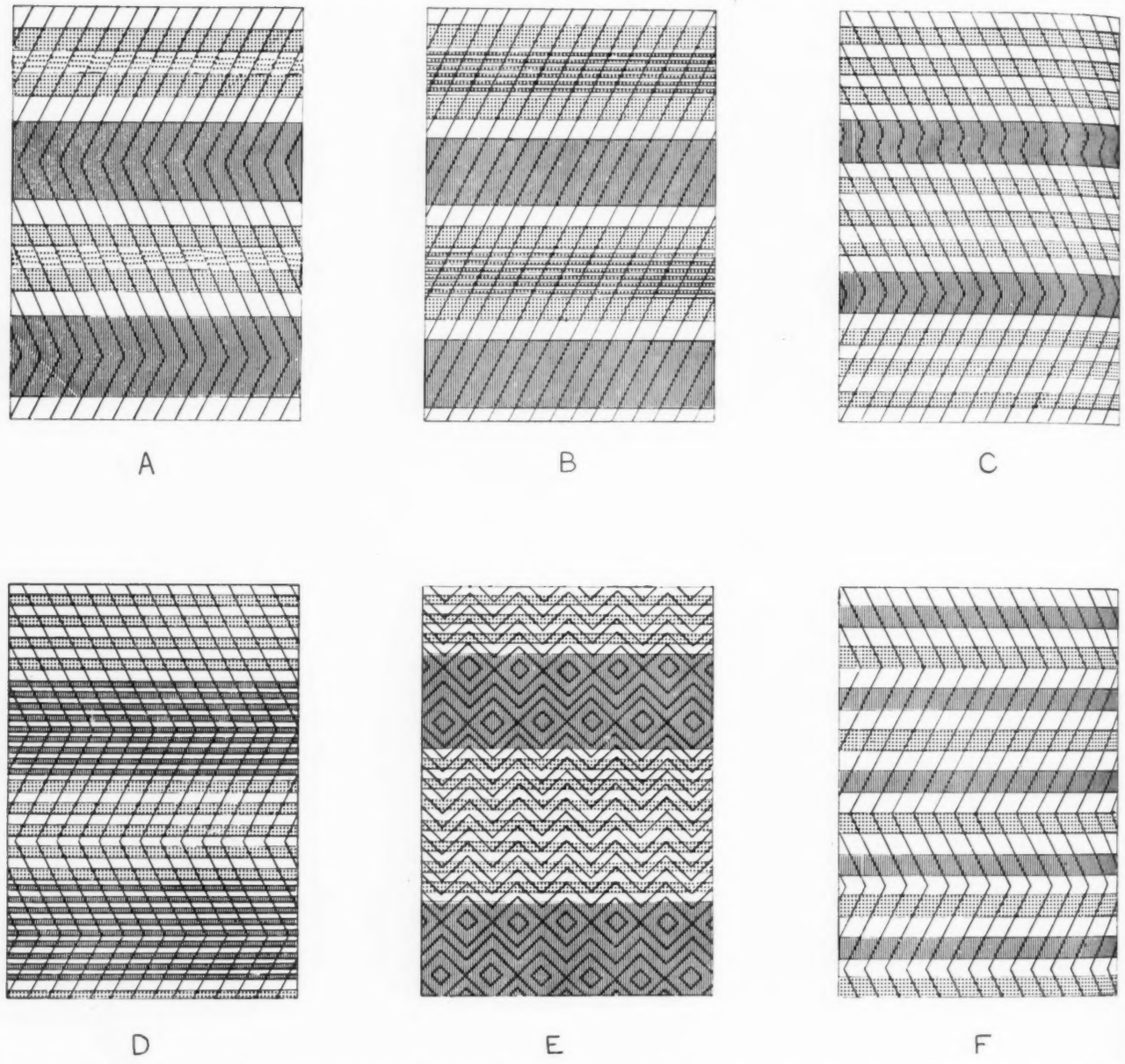


FIG. 81. Anasazi stripe twill patterns woven with red, white, and brown or black wefts. The direction of twill ribs is shown by the diagonal lines superimposed on the pattern. (Dotted shading indicates red stripes; vertical line shading indicates black or brown.)

within the dark band. Twill diagonals may reverse direction here, or, in the case of diamond twills, the diamond figures will be completed, in contrast to the herringbone pattern woven in red and white stripes (fig. 81, A, C, E). In two Anasazi stripe cloths this need to break the monotony of dark bands is expressed by weaving in narrow white line designs in interlocking twill tapestry (AMNH 29.1/7679A and 29.1/7895C, White House).

The simple method of designing a cloth by weaving in variously colored bands of weft thread has been noted but once on plain weave cloths (p. 491). Weft stripes are naturally more effective on a strongly weft-face fabric. Twill cloth, approximating tapestry weave in the close battening of wefts, offered a better medium for weft-stripe patterns than did ordinary plain weave.

The term *Anasazi* was chosen for these striped cloths because they are so patently the product of Basketmaker-Pueblo culture. For one thing, all were found in Anasazi sites. None has so far been reported from villages in central or southern Arizona or southwestern New Mexico. Furthermore, decorative bands on these Pueblo III loom-woven cottons are strikingly similar in nature to those on San Juan Basketmaker twined-

woven bags of apocynum and yucca fiber, particularly the ones done by the "dyed-weft" process.[113] Wefts of the bags are natural color apocynum thread, with stripe patterns carried out, almost always, in red or black. Stripes are solid or beaded, and vary greatly in width. Sometimes colored wefts make a pattern of zigzag lines, similar to the effects produced by reversed and herringbone twills. It is almost as though Basketmaker twined-woven bag patterns were copied in loom-woven twill cloth by early Anasazi weavers, and the traditional red and black stripe designs handed on right through Pueblo III times by the conservative people of the north. Indeed, certain characteristics of Anasazi twill cloth appear even in contemporary Pueblo work, in particular the practice of weaving diamond patterns into *dark* weft bands, and the orienting of fancy twill (particularly diamond) into decorative borders, for example on women's dresses and shawls and the ends of men's breech cloths.[114] The shape of early Navaho "chief" blankets and their weft stripe patterns may have been copied from Anasazi stripe twill blankets in the late 1600's.

Other similarities between the Anasazi stripe twill cloth of Pueblo III and Basketmaker material may be noted. The zigzag lines on a Basketmaker II plain weave apocynum cloth from Tsegi-ot-Sosi are not unlike twill weave patterns,[115] and the designs painted on the upper portions of human figures in Basketmaker pictographs from northern Arizona also resemble effects achieved by twill weave.[116] It has been suggested by Guernsey and Kidder that the pictographs are intended to represent figures wearing shirts or blankets woven of apocynum fiber.[117] It is possible that the designs on such fiber cloths were copied in loom-woven cotton twill cloth by the Puebloans, and the tradition of striped upper garments thus carried on into Pueblo times.

The Relationship of Basketry Patterns to Twill Weave Cloth

Diamond, herringbone, diagonal, reversed, and irregular twill patterns are perfectly familiar to basket and mat weavers the world over. Within the Southwest they may be seen particularly on the twill-plaited ring baskets woven by the Anasazi since Basketmaker times, and still manufactured in several Pueblo villages. The Hohokam probably also wove twill-plaited baskets and mats before the advent of loom and cotton.[118] It is perfectly reasonable to suppose that the idea of twilling was transferred to cloth just as soon as loom weaving was understood. The known Basketmaker III ring baskets are woven in simple self-patterned twill, while those of Pueblo III are characterized by more complex designs in black and white. Experimenting with the pattern possibilities of twill rhythms apparently went on simultaneously in loom weaving and twill-plaiting among the Anasazi from early Pueblo times.

The Distribution and History of Floated Weave Cloth

Weft-float Pattern Weaves

Weft-float pattern weaves are too limited in number and too widely distributed in space and time to make possible any valid statements as to their history within the Southwest. The best examples come from Montezuma Castle (Pueblo IV), White House, and Grand Gulch (Pueblo III). Fragments of what are probably weft-float weaves come from the Pueblo III sites of Lenaki and Kiet Siel. The weave was practiced in prehistoric Peru[119] although building a design with *warp* floats, rather than *weft* floats, was more common there. The only record of weft-float pattern weave from regions between Peru and the Southwest is the description by O'Neale[120] of its use in narrow decorative bands on contemporary textiles from Highland Guatemala. It is rarely seen, even in this limited form. The technique is not practiced in the Southwest at the present time.

Twill Weaves

Twills come from at least twenty-four sites, seventeen of which are Pueblo III Anasazi in horizon. Of the fifty-eight known examples, all but seven are from these sites. Three of the seven, from Hidden House, Wupatki, and "the vicinity of Wupatki," are Pueblo III Sinagua; one is Pueblo IV Sinagua from Montezuma Castle; and one, from Tonto, is Salado. There is also the Pueblo III twill from Tularosa Cave, and the somewhat earlier piece (900–1100) from Los Guanacos. In addition to the twill cloths I have seen, there are references to twilling at Kinishba and in the "Salt River Valley."[121] There are also twilled cigaret sashes from Double Butte Cave and Wupatki (Appendix C, chart 23).

The Los Guanacos cloth, in the simple artfulness of its weave, shows more than a nodding acquaintance with twill processes. The pleasing pattern results from a highly skillful synchronization of colored warp and weft threads with a basically simple heddle rhythm. It was not done by a person newly initiated into the mechanics of twill weaving, but suggests this art was common among the Hohokam at a very early date, perhaps resulting, as we have suggested (see above),

[113] Guernsey and Kidder, 1921: 70. The following discussion is based particularly on this reference, pp. 70–71, plates 25, 26, 27, 29 and 30.

[114] Douglas, 1940 *c*: 184.

[115] Guernsey and Kidder, 1921: pl. 26, *c*.

[116] Kidder and Guernsey, 1919: figs. 100, 101.

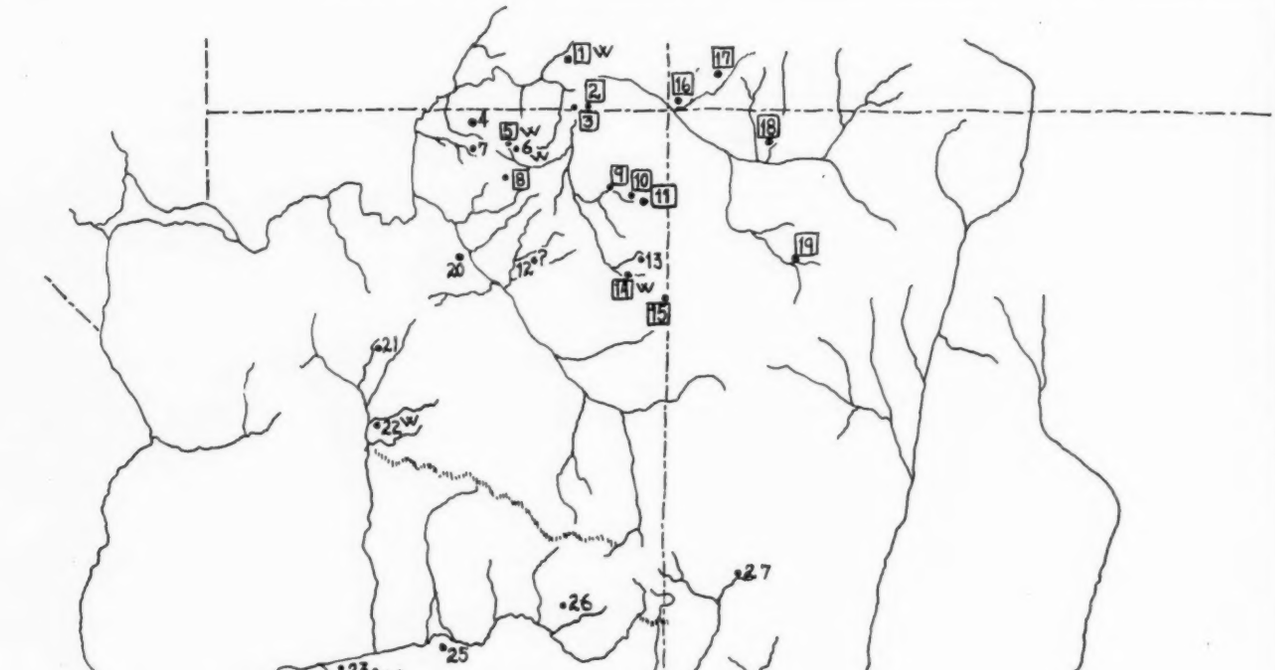
[117] Guernsey and Kidder, 1921: 65.

[118] Haury *et al.*, 1950: 401. Morris and Burgh, 1941: 19–21, figs. 10: 34–38.

[119] O'Neale, 1937: 178–179, 209.

[120] O'Neale, 1945: 68.

[121] Baldwin, 1939: 321. Cushing, 1893: letter to J. H. Docking, Dubois, Pennsylvania, regarding textiles on mummies from the Salt River Valley.



MAP 8. The distribution of twill and weft-float pattern weave cloths. (Boxed numbers indicate sites yielding Anasazi stripe twills. A question mark is placed after number 12 (Awatovi), as, while twill is thought to be represented in the murals, there is some doubt that this is so. *W* placed after a site number indicates that weft-float pattern weave as well as twill was found there.) (1) Grand Gulch. (2) Floating House. (3) Waterfall Ruin. (4) Navaho National Monument. (5) Kiet Siel. (6) Lenaki. (7) Gourd Cave. (8) Marsh Pass, Cliff House #8. (9) Hospitibito Canyon. (10) Painted Cave. (11) Zele Cave. (12) Awatovi. (13) Mummy Cave. (14) White House and Canyon de Chelly. (15) Black Creek, LA #1521. (16) Southwestern Colorado. (17) Mesa Verde. (18) Aztec. (19) Pueblo Bonito and Chetro Ketl. (20) Wupatki. (21) Hidden House. (22) Montezuma Castle. (23) Double Butte Cave. (24) Los Guanacos. (25) Tonto and the Salt River Valley. (26) Kinishba. (27) Tularosa Cave.

from the conscious duplication of twill-plaited basket designs in loom-woven cloth.

We have no actual pieces of twilling from the northern Pueblo area before 1100. However, we have already noted the marked resemblance between Anasazi stripe twill cloths and patterns on Basketmaker twined-woven bags, pictographs, and painted fiber cloth—likenesses indicating that this particular textile design style continued without a break from pre-cotton through recent horizons. We have also mentioned Anasazi ring baskets as a source of twill design in the north. Yet another argument for the early development of twill weaving among the Anasazi is the fact that by Pueblo III it was practiced all over their domain, even at Mesa Verde, Aztec and other northern and eastern villages to which certain techniques, as for example weft-wrap and gauze, seem never to have penetrated.

There is the further suggestion that among the Hohokam twilling may have been supplanted, perhaps shortly after 900, by weft-wrap, and later by brocade and embroidery, all techniques which result in elaborately decorated fabrics, but which do not require more than the two warp controls needed for plain weave. By early historic times southern Arizona Indians wove only plain weave blankets and warp-patterned belting. Among the Pueblo peoples, on the other hand, the fine art of twilling was developed in all its complexities. Elaborately figured tapestries were woven in this technique, as well as a variety of self-patterned and striped twills. In the north, particularly, the preoccupation

with twill rhythms was intense. Even the embroidery (brocade?) patterns on cloth from Anasazi sites resemble twilling, and brocading and weft-float are generally found with twill, rather than plain weave, cloth. There is one possible example of twilling, in the form of a kilt, illustrated in the Jeddito murals.[122] Twills are still basic in Pueblo weaving, being used for men's kilts, shirts, and breech cloths, and women's dresses and shawls. The Hopi plaid blankets may be woven in diamond or reversed weave.[123] The Navaho, instructed originally by Pueblo weavers, also make use of twill weaves for certain of their textiles.

The emphasis on twill techniques among the Anasazi weavers at the far northern limits of the New World cotton-and-loom complex, contrasts sharply with the lack of interest in twills shown by the Peruvians at its southern limits. Of several thousand cloths examined by her, O'Neale found only *seventeen* to be wholly or partially twill-woven.[124] Eight of these come from Early Period sites, showing that twill-weaving was mastered at the very beginning of the loom industry. The fact that several different heddle rigs were used in the seventeen cloths indicates the mechanics of twilling were no mystery. For some reason, however, the technique never became popular. Concerning this phenomenon, O'Neale writes (*op. cit.*, 269):

> During certain periods in Peruvian prehistory, the ancient weavers evidenced pronounced interest in embroidery, or brocading, or gauze, or other technique. There appears at no time to have been a comparable interest in twills. Their rarity cannot be explained. It seems extraordinary to an analyst that craftsmen whose imagination and ingenuity have been repeatedly and conclusively proven should not have exploited a method of interlacing threads with such manifest texture and pattern possibilities.

There are no archaeological examples of twill cloth between Peru and southern Arizona, and apparently little interest in or knowledge of the process historically among Mexican or Central American weavers. The limited use of the pattern possibilities of this technique in Highland Guatemala has been remarked upon by O'Neale.[125] The skirts of Aztec women of Cuetzalán, Puebla, are reported to be of diagonal twill weave.[126] I find no other mention of twill cloth in Mexico.

The most elaborately patterned textiles of Peru, and probably of Central America, Mexico, and even southern Arizona were constructed basically as plain weaves, requiring only two warp controls—heddle and shed rod. In Peru, the finest decorative effects were achieved mainly through tapestry weave, very simple embroidery, or gauze. The first two techniques are really needle processes, and the third is dependent on finger manipulation of warps, rather than on mechanical controls. There is not much information about textile techniques in pre-Spanish Mexico and Central America. Tapestry, embroidery, and gauze may have been important, and brocade on plain weave cloth was probably one of the basic decorative techniques, as it is today. In southern Arizona, as we have remarked, weft-wrap, gauze, embroidery, and brocade were probably the important decorative techniques. The fabrics produced by these several techniques were often of spectacular beauty, but the fact remains that none of the processes required the same high degree of technical skill and calculation as twill weaving.[127] The prehistoric Pueblo peoples of central and northern Arizona and New Mexico have earned a distinctive place for themselves in the annals of New World weaving through their exploitation of the mechanical possibilities of their loom. It is especially apparent that the Anasazi, having received cotton and knowledge of the two-bar loom with loop heddles perhaps around 700, handled these acquisitions in their own fashion, fitting them into an estab-

FIG. 82. Blue-gray tie-dye cloth from Gourd Cave. (ASM 2984. Photo by E. B. Sayles.)

[122] Smith, 1952*b*: fig. 24, *c*. See also our fig. 142, A.
[123] Douglas, 1931; 1939*a*, *b*, *c*; 1940*a*, *b*, *c*.
[124] O'Neale, 1946.
[125] O'Neale, 1945: 70.
[126] Cordry and Cordry, 1940: 48.
[127] *Cf.* O'Neale, 1946: 293–294.

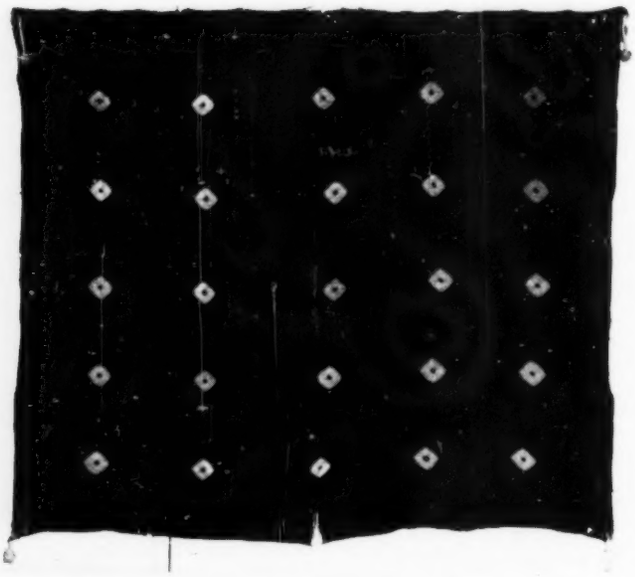


FIG. 83. Brown tie-dye blanket from Lake Canyon. Width, 51½". (UM 29.43.183. Photo by Taylor Museum.)

lished textile tradition, by transferring basket and mat designs to loom-woven fabrics. Other influences on technique and design reached them from southern Arizona, but never dominated their native art forms. They developed an industry characterized by use of the wide, upright loom, weft-face cloth, and multiple-heddle weaves (twills), in contrast to textile industries of Peru, central and southern Mexico, and Central America which were based on the waist-loom, warp-face cloth, and two-heddle weaves. The Hohokam textile arts between 1000 and 1400, *as we know them*, are technically more closely allied to those south of the border than to the Pueblo development.

APPLIED DECORATIVE TECHNIQUES

Introduction

Several methods were used for applying design to plain weave white cloth after it had been removed from the loom. There are examples of tie-dye, painting on cloth, embroidery and couching. Embroidery has already been discussed in connection with brocade (pp. 510–518).

1. *Tie-Dye*

Definition

Tie-dye is a simple form of resist dye wherein the cloth is folded together at certain points and wrapped so tightly with string that coloring matter cannot penetrate.

Technical Description

Nine examples of tie-dye, from as many sites, have been recorded.[128] Eight resemble each other stylistically, their designs being composed of series of small white circles, or (more commonly) squares with rounded corners, each with a tiny dot of color at its center. The circles, or squares, represent places at which the cloth was tied off so as to resist dye, the center dots probably indicating the point held between the worker's fingers as he wrapped his string about the folds beneath it. Light streaks often radiate from the "corners" of the squares, the result of creases in the material where dye did not penetrate thoroughly. The undyed circles or squares are from ¼ to ⅜ inch across, and are usually spaced about ½ inch apart in two parallel rows. These double rows of white spots are placed diagonally on the cloth so as to create geometric designs (fig. 82). Unfortunately, all the examples are so fragmentary that we cannot reconstruct the patterns in any detail. They were probably similar to that on the Awatovi kilt reproduced in figure 140, G. The dye is blue-gray in three instances, brown in four, faded yellow (probably once brown) in one, and black in the last.[129]

The outstanding example of the art of tie-dye in the Southwest is somewhat different from the pieces just described. This is the complete blanket from Lake Canyon, southeastern Utah (UM 29.43.183; fig. 83). Beautifully woven from fine-spun cotton, and in an excellent state of preservation, the blanket measures 51½ inches with the wefts and 44 inches with the warps.

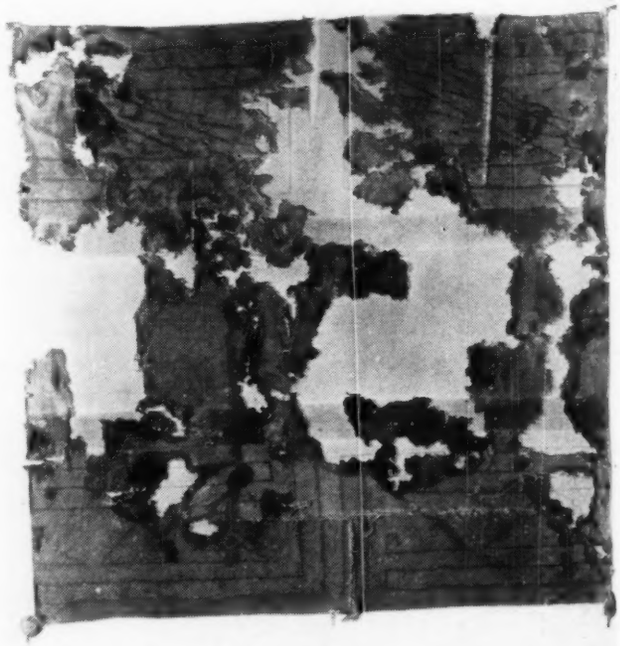
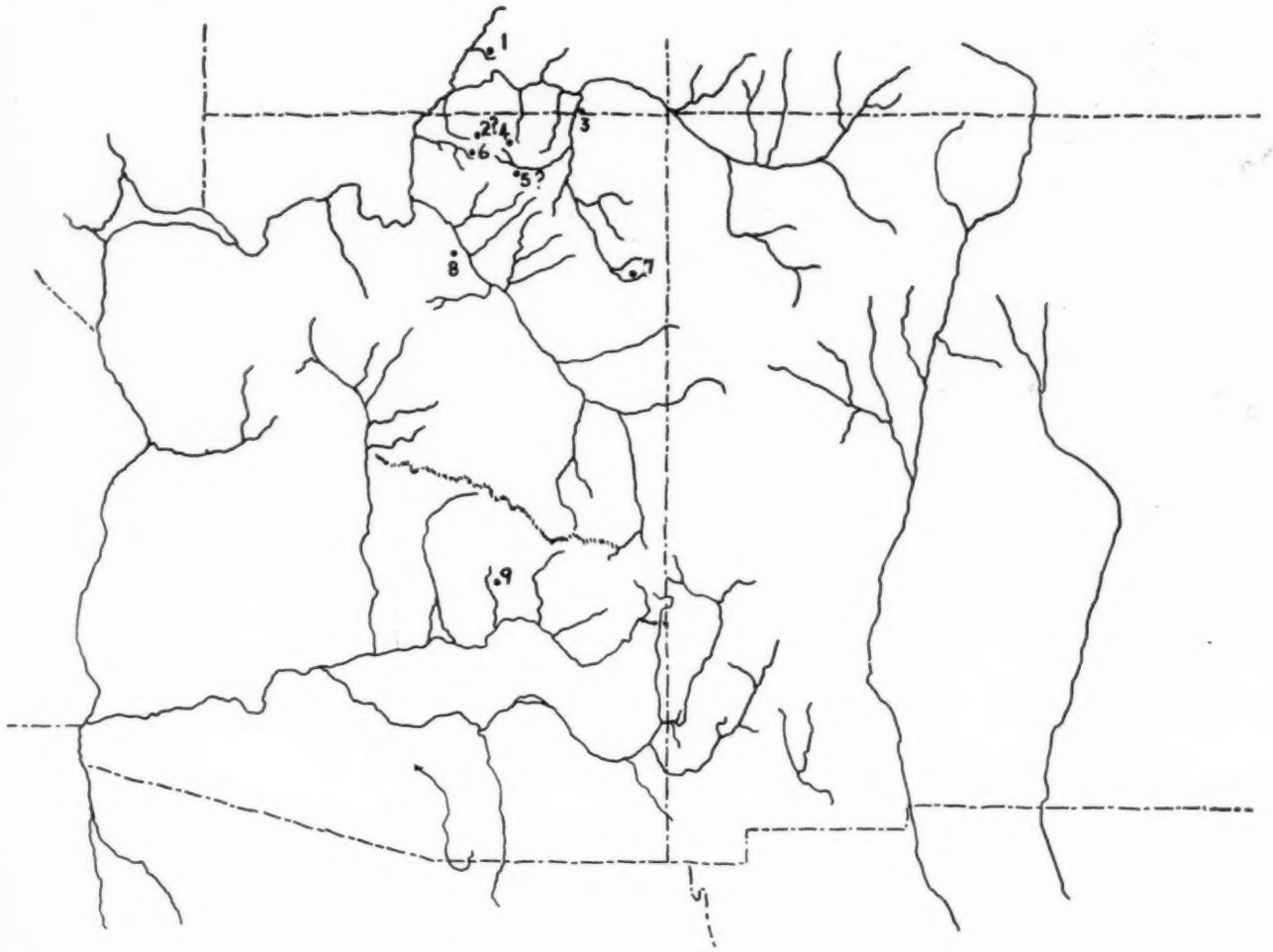


FIG. 84. Painted poncho from Painted Cave. Length, 33". (Photo by Amerind Foundation.)

[128] See Appendix C, chart 9, *a*.

[129] Concerning the black fabric, from Wupatki, Dr. Haury quotes Mr. John C. McGregor as saying that the dye contains copper and may not have been black originally. Haury, 1934: 100.



MAP 9. The distribution of tie-dye cloths. (Question marks indicate doubtful proveniences.) (1) Lake Canyon. (2) Northern Arizona. (3) Waterfall Ruin. (4) Kiet Siel. (5) Kayenta region. (6) Gourd Cave. (7) White House. (8) Wupatki. (9) Canyon Creek.

At each corner is a small, square white cotton braid with a pompom, or ball, at its end. The dye is brown. Large white diamonds, $1\frac{3}{4}$ inches across, with $\frac{1}{4}$ inch square dots of color in their centers, are arranged in five parallel rows on the blanket. Each row contains five diamonds, so that there are a total of twenty-five.

None of the other tie-dye fabrics is large enough to give a hint of its original size and use. However, the technique is admirably suited for decorating large cloths with ease, and we may assume it was used chiefly for blankets and kilts.

The Distribution and History of Tie-dye

All but two of the examples of tie-dye come from Anasazi villages and date probably from Pueblo III. Sites represented include: Kiet Siel, Lake Canyon, Gourd Cave, White House, Waterfall Ruin, the "Kayenta region" and "northern Arizona." There is a piece, also Pueblo III in date, from the Sinagua village of Wupatki, and one Salado example from Pueblo IV Canyon Creek. The lack of tie-dye from southern Arizona and its relative scarcity in Sinagua and Salado sites is curious. There can be little doubt that the technique spread northward to Mexico and the Southwest from Peru, where examples almost identical in design to those described here have been found.[130] The Hohokam may have learned the process first from neighbors to the south and, having passed it on to the Pueblo peoples north of them, discarded it in favor of other decorative techniques. Or, tie-dye may have reached the Pueblo area via the Eastern Mogollon from Chihuahua. Whatever its source, this simple resist-dye technique may have furnished the original impetus towards negative patterning which is so well expressed by Pueblo III

[130] Crawford, 1916: 152–156, fig. 28. The evidence for tie-dye in Mexico was furnished by Miss Elsie McDougall in correspondence, July 25 and August 11, 1941. She identifies certain textiles in Aztec depictions as tie-dye; and has collected modern samples from the Otomi and from Zacatecas and Hidalgo states. In her opinion the art was well distributed throughout Mexico. The material used among the Otomi today is a bast, the agave, and the bits of cloth not intended to receive color are tied off with threads of the same fiber.

FIG. 85. Painted textile from White House. (BM 03.251. Photo by Brooklyn Museum.)

on painted blankets (see below, pp. 570–573) and Kayenta black-on-white pottery. The fact that elements of tie-dye patterns are basic in Pueblo textile design as a whole may indicate that this was an early, widespread Pueblo decorative technique (see p. 637). There are no records of tie-dye historically in the Southwest, but the fact that kilts and shirts illustrated in the Jeddito murals are decorated by this method show that it remained in use in northern Arizona at least up to Spanish times.

2. *Painting on Cloth*

Technical Description

The application to finished cloth of color in the form of designs painted on with a brush is represented by twelve examples from nine sites.[131] The colors used are: black, yellow, red, brown, and green. These were painted on one surface of the cloth. There was apparently no attempt at a preliminary sizing of the material, and the paint generally shows indistinctly on the under surface. Painting was probably done with yucca fiber brushes of the type used in decorating pottery.

One piece, from Canyon Creek, is a bag with a band of red paint, ¾ inch wide applied to the sewed edge. I have not seen the Mesa Verde and Montezuma Castle examples. The former is described as: ". . . A small piece of painted cloth with a dark brown pattern," and the latter as: ". . . Fragments of a cloth blanket with a solid black background bordered with red."[132] The pattern of the Painted Cave poncho is described by Dr. Haury[133] as:

> . . . A simple linear construction in a brown color with faint black framing lines. . . . Several small areas of pale green color suggest that the background may have been this tone originally. . . . The arrangement of the pattern in two zones at the ends, leaving the central third free of design, may mean that a belt was worn about the middle (fig. 84).

Of the remaining eight examples, three are complete blankets, one a shirt and the other four probably blanket fragments. The shirt from Poncho House (fig. 113, F) and the fragments from White House and "Kayenta" (?) are alike in being decorated entirely by a negative design technique. These cloths are completely covered by paint except for a series of small rectangles, rhomboids or narrow lines which, left the natural white of the fabric, form patterns against the darker ground (fig. 85). The effect is of resist dyeing, the Kayenta pieces, in particular, with their gridwork of white squares with central brown dots, being reminiscent of

FIG. 86. Painted blanket from Painted Cave. Width, 53″. (Photo by Amerind Foundation.)

[131] See Appendix C, chart 9, *b*. A thirteenth piece, a breech cloth from Floating House, *may* have been painted. It is not included in the following discussion, but is mentioned on p. 613.

[132] Haury, 1945*b*: 74–75.

[133] *Ibid.*, 32.

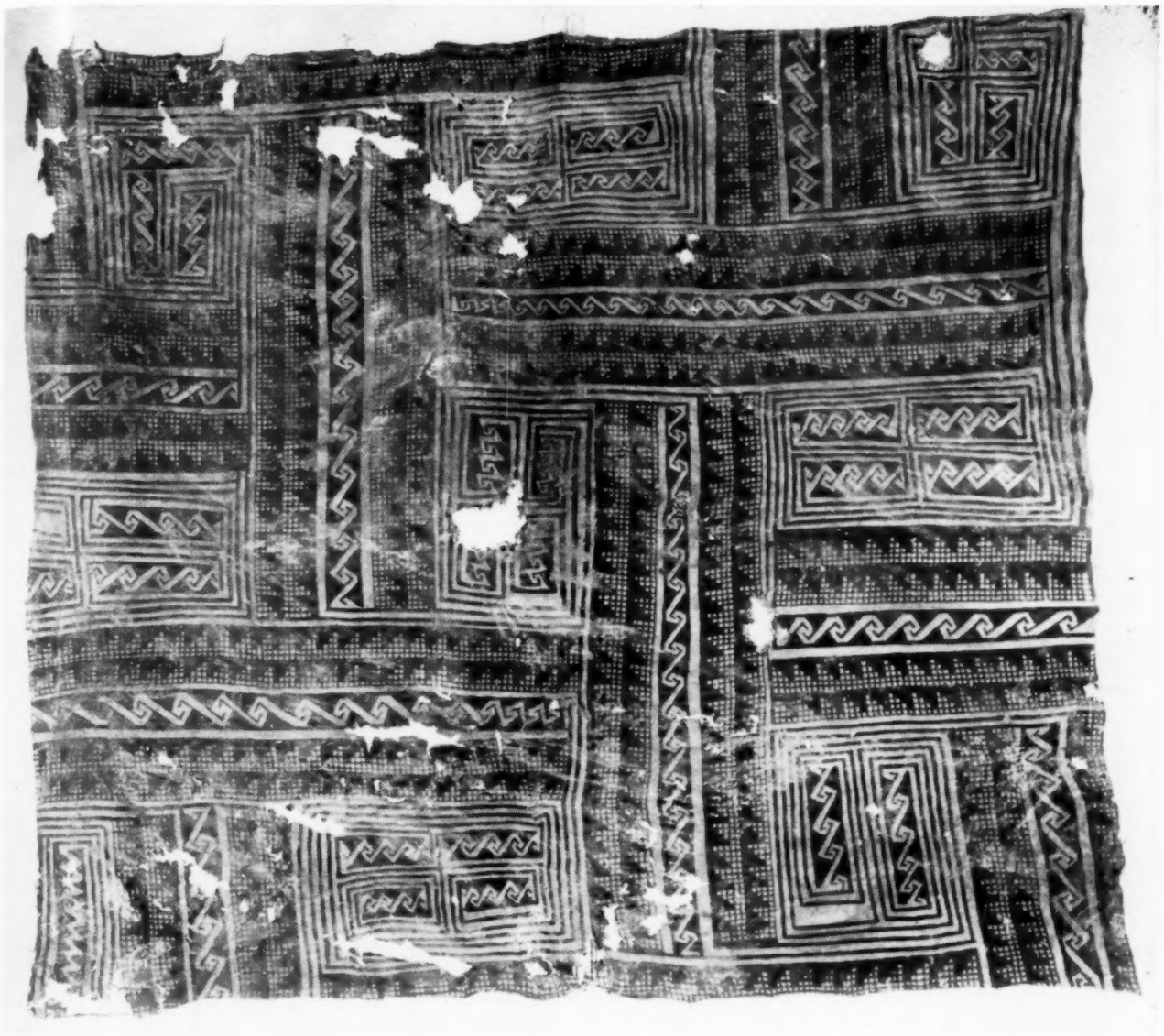
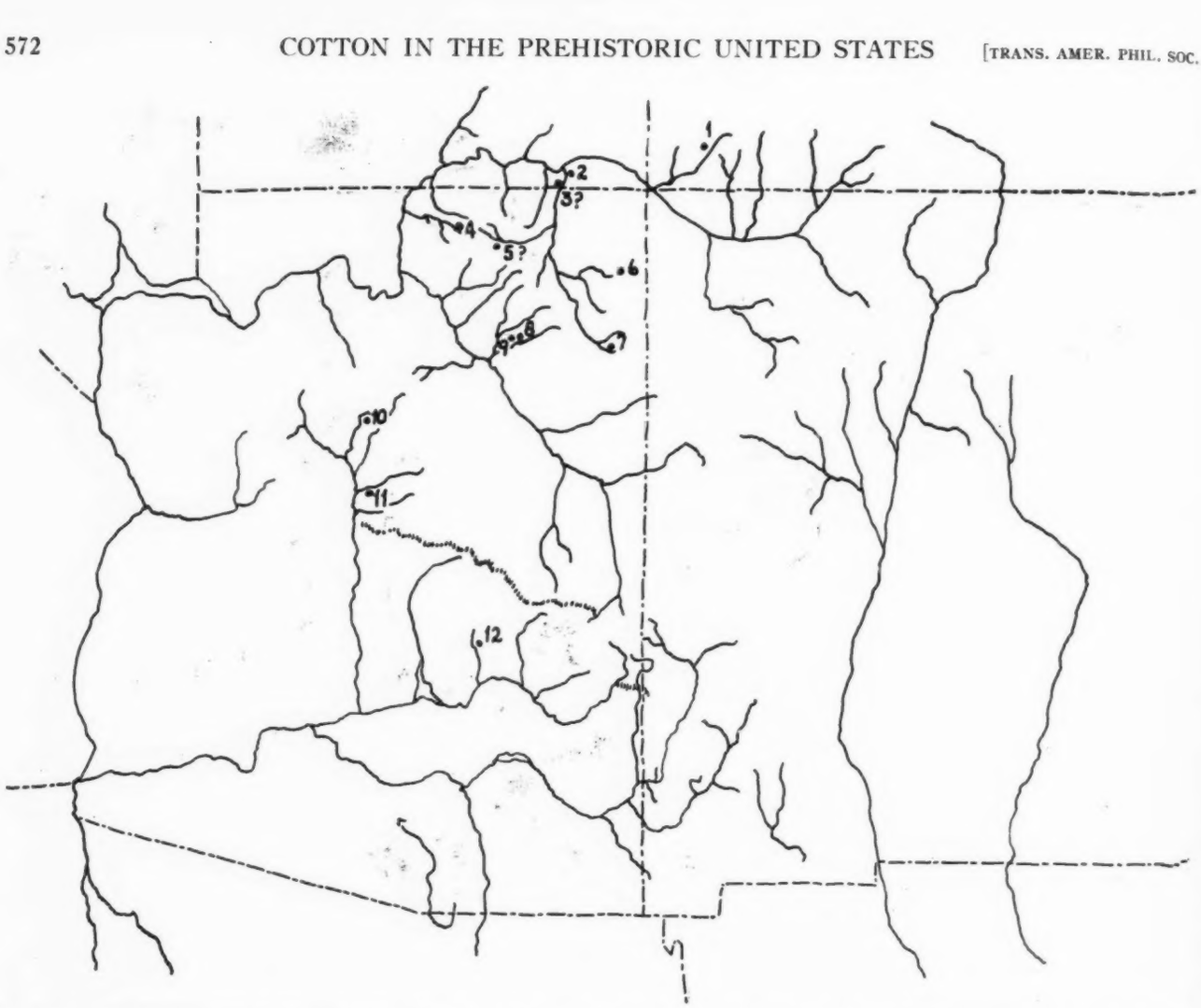


FIG. 87. Black and white painted blanket from Hidden House. Width, 64". (ASM 20511. Photo by E. B. Sayles.)

tie-dye patterns (fig. 137, B). The designs on these cloths should be compared with those on Pueblo III black-on-white pottery from Kayenta. The White House fragment resembles closely pottery illustrated by Kidder and Guernsey.[134] If enough remained of these pieces, the pattern lay-out might be like that seen on the two complete blankets from Painted Cave. Both of these have red painted borders. The design area within the borders is divided into quadrants offset around a central square. The main design lines run oblique to the warp-weft axis. Within each quadrant are broad bands of solid color or of small geometric design units. Certain of the patterned bands show negative designs in black and white (the natural cloth color) (fig. 86). The Little Kiet Siel cloth was probably very like the Painted Cave blankets. The orientation of pattern into quadrants offset around a central square or diamond has been mentioned in connection with weft-wrap, brocade and twill tapestry cloths.

The black and white blanket from Hidden House is unique in two respects (fig. 87). The design is composed of small geometric elements combined into larger rectangular units and bands. There are no extensive areas of solid color as in other painted blankets. Furthermore, whereas the cloth is quartered, with design bands offset about a central rectangle, these bands *parallel* the warp-weft axis, instead of being oblique to it. This arrangement is most unusual, not only in painted cloth, but in textile designing as a whole. The artist appears to have broken a tradition of long standing. The resemblance of the design on this piece to

[134] Kidder and Guernsey, 1919: 132–133, figs. 53 and 54*a*.



MAP 10. The distribution of painted cotton cloths. (A question mark is placed after number 5 to indicate doubtful provenience. The question mark after number 3 indicates there is uncertainty as to whether painted cloth was found in Floating House.) (1) Mesa Verde. (2) Poncho House. (3) Floating House. (4) Little Kiet Siel. (5) Kayenta Region. (6) Painted Cave. (7) White House. (8) Kawaika-a. (9) Awatovi. (10) Hidden House. (11) Montezuma Castle. (12) Canyon Creek.

Kayenta black-on-white pottery is striking, and gives rise to the opinion that this cloth may be trade goods.

Little more remains to be said of painted designs except to point out that the large round spots on the Poncho House shirt, and the small circles on some tie-dye cloth, are the only examples of curving design elements on Pueblo textiles. In spite of the fact that painting—even more than embroidery—gives the artist complete freedom of choice in the forms he wishes to place on the cloth, we see only elaborations of the customary angular textile patterns.

The Uses of Painted Cloth

Painting was probably applied principally to large articles. The collections include, as we have seen, blankets, a poncho, a shirt and a bag. (A breech cloth from Floating House may also have been painted.) Judging from the Jeddito murals kilts were also painted, at least after 1400.[135] Accounts of Rio Grande Pueblo clothing around 1580 mention hand-painted garments, among them cotton shirts.[136]

The Distribution and History of Painting on Cloth

Nine of the twelve examples of painted cloth come from Anasazi villages—Mesa Verde, Little Kiet Siel, Poncho House, Painted Cave, White House, and the "Kayenta Area." These all date to Pueblo III, as does a tenth piece, from Hidden House. Somewhat more recent in time are fragments from Montezuma Castle and Canyon Creek.

Painting on cloth is generally felt to be a typically Anasazi method of decoration, stemming from pre-cotton horizons.[137] Basketmaker textiles with painted

[135] Smith, 1952*b*, fig. 24, 1. See also our fig. 142, E.

[136] Winship, 1896: 517.

[137] Haury, 1945*b*: 75: "The present evidence indicates that northeastern Arizona was the key area for the technique." Mera, 1943: 7: " . . . The application of pigments to fabrics first

designs include plain weave fiber cloth, twined-woven bags[138] and carrying bands (fig. 47, A, 1). The tradition, established before 700, was continued into historic times. We have mentioned the early Spanish accounts of painted cloth among the Rio Grande Pueblos. Mera finds references to the technique as late as 1639.[139] This ancient method of decoration has virtually disappeared today, being used only on some ceremonial dance kilts.

3. *Couching*

Definition

The appliqué of cord to the surface of a cloth is called couching.

Technical Description

Represented by only one example, a breech cloth (p. 613) of unknown origin (USNM 250178), couching cannot be considered an important decorative technique in the prehistoric Southwest. Three strings, placed close together, form a narrow ridge running diagonally across the front of the plain weave cloth. Each string is overcast to the surface of the fabric (fig. 116, C). The effect is somewhat like that of the "raised" threads found on certain Pueblo men's breech cloths and women's dresses as a dividing line between the border and the body of the cloth. These threads are not appliquéd to the cloth, however, but are sewed into it.[140]

FIG. 88. Twine-stitch darning in two-ply tan thread on worn red plain weave blanket. Burial #22, Ventana Cave. (Photo by E. B. Sayles.)

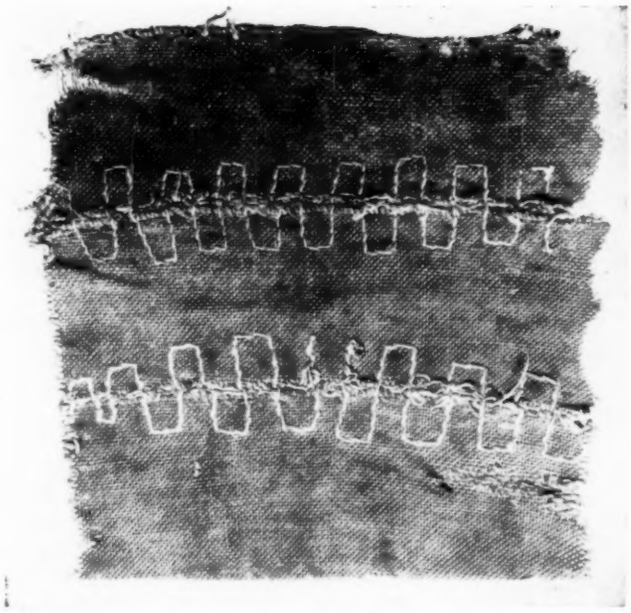


FIG. 89. Twine-stitch used in mending torn cloth, Nitsie Canyon. (ASM 1110. Photo by E. B. Sayles.)

SEWING AND FINISHING TECHNIQUES

Introduction

There are some features of woven cloth which we have not yet discussed. These may be classed under two headings: first, sewing techniques—darning, patching, seaming, and overcasting raw edges; and second, various methods of finishing the edges and corners of cloth—as selvages, fringes, corner braids, and tassels.

1. *Sewing Techniques*

The prehistoric weavers exercised real artistic genius and great patience in constructing fabrics, but their talents did not extend to sewing. Whenever possible, they wove each article to shape on the loom—large, rectangular blankets, smaller rectangles for kilts, ribbon-like ties and sashes, loom-joined breech cloths, carrying bands, and so forth. None of the precious cloth was wasted by tailoring and cutting methods such as we use. Occasionally, however, they did find it necessary to sew, as when making bags and quivers,

begins far back in Pueblo pre-history, to a time so remote that elemental finger-weaving had not yet been replaced by fabrics woven on a true loom."

[138] Guernsey and Kidder, 1921: 65, 72–74.

[139] Mera, 1943: 7.

[140] Douglas, 1940*c*: 182, H and N.

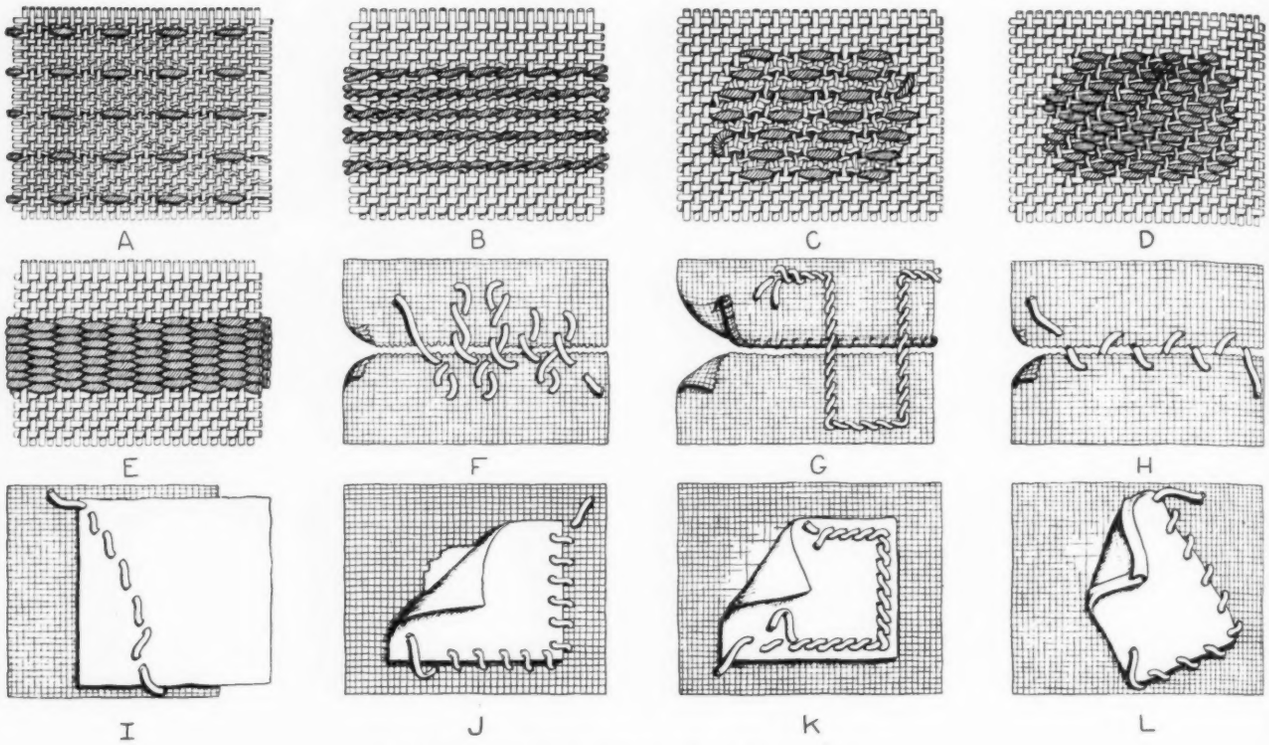


FIG. 90. Darning, mending and patching techniques.

A. Running-stitch darn.
B. Twine-stitch darn.
C, D. Running-stitch darns (?) in twill rhythm. Gourd Cave. (ASM 2787b and 3013.)
E. Close-packed darning (?) stitches. Oak Creek. (MNA 259/1128.)
F, G, H. Methods of mending torn cloth. (F. Hidden House. ASM 20492. G. Nitsie Canyon. ASM 1110. H. Saddler's stitch, frequently used.)
I. Common method of sewing patches to worn cloth.
J. Patch sewed on with overcast stitch. Gourd Cave. (ASM 3023.)
K. Patch sewed on with double thread in twine-stitch technique. Gourd Cave. (ASM 3023.)
L. An unusual patch, with edges turned under. Gourd Cave. (ASM 2067.)

and their efforts are crude indeed. A good example of this is the large quiver from Hidden House (fig. 39), wherein the haphazard construction of the piece contrasts sharply with the elaborately patterned tapestries from which it is made.

Attempts at darning cloth, sewing up tears, or overcasting torn edges are, in the main, slovenly, careless, and probably ineffectual. This is true in spite of the fact that the people apparently attempted to extend the life of their fabrics as long as possible. The majority of fragments and complete articles show signs of long usage; most are darned and many are patched.

Sewing threads are generally two-ply natural-color cotton, although single-ply thread might also be used, as at Tonto. From that village also come examples of three- and four-ply mending threads. Orange-red cotton appears as darning material on fragments of white cloth from Burial #9 at Ventana Cave, and brown thread was used in darning a blue-gray cloth from Wupatki (MNA 77/NA405.M231). Dyed threads must have been too valuable to be wasted in mending, as a rule. Probably only odd bits left over from weaving a colored fabric would have served such ends. Occasionally yucca twine served as darning or sewing thread. (See discussion of bags, pp. 621–625).

In sewing, as in embroidery, the needle was never forced through the threads of the cloth, but was inserted in warp-weft interstices. This practice probably resulted from following the line of least resistance, the yucca leaf tip needles being too thick to pass easily through a fine-spun thread.

Darning

Running and twine stitches are the standard darning techniques from all sites. These have already been named as embroidery stitches, also, and the suggestion made that embroidery developed from darning through the realization that stitches on the surface of the cloth could be made to have decorative value. This view is supported by the fact that in some cases it has been impossible to determine whether stitching was intended to serve practical or aesthetic ends.

Darning stitches, with few exceptions, are arranged in regularly spaced rows parallel to the wefts. Since

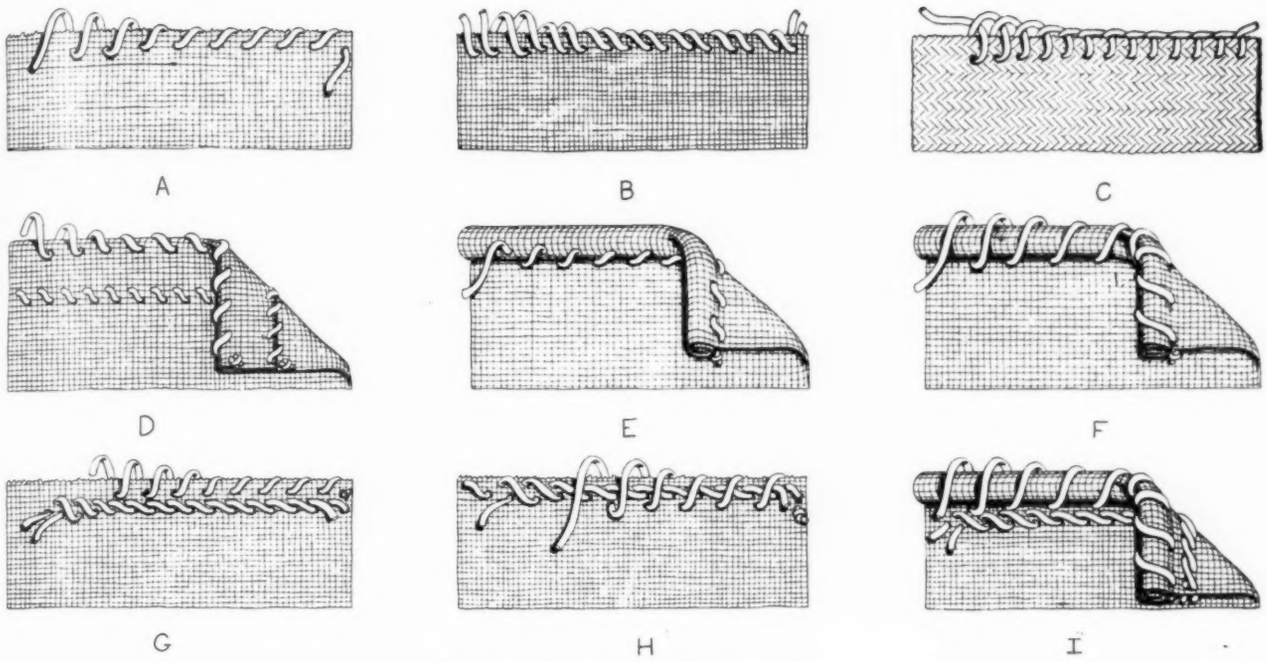


FIG. 91. The treatment of raw edges.

A. Overcasting the edge.
B. Overcasting the edge with two threads. Kiet Siel. (MNA 695/NA2519.M276.)
C. Buttonhole stitch used to mend the frayed edge of a flat braid. Gourd Cave. (ASM 2896.)
D. A cut or torn edge folded, sewed down and overcast. Kiet Siel. (MNA 695/NA2519.713.)
E. Raw edge rolled and sewed.
F. Raw edge rolled and overcast.
G, H, I. Torn edges reinforced by twine-stitches and overcasting. Gourd Cave. (ASM 3022i, 3022o, 3023.)

wefts have a tendency to wear out of the web first, it is logical enough that the darning material was generally inserted so as to strengthen or replace them. The stitches on a given cloth tend to be of uniform length, the thread passing over and under a set number of warps, generally two to four. Figures 88; 89; 90, A and B illustrate typical twine-stitch and running-stitch darns.

Two fragments from Gourd Cave (ASM 2787b and 3013; fig. 90, C, D) demonstrate the confusion between darning and simple embroidery. Both have running stitches worked back and forth over worn areas in twill rhythm. Classified at first glance as darns made to simulate twilling, these fragments later presented themselves as possible embroideries (or brocades) when further study of textiles from the same site revealed the "false-twill" running-stitch embroideries described on page 513.

Other controversial fragments come from Oak Creek (MNA 259/1128, etc.). These have a "ridge" of wefts consisting of sixteen threads pressed closely together after the fashion of tapestry into a narrow band less than a half inch wide. This fills in what would appear to be a place in the cloth where wefts wore out. Stitches pass over and under groups of three warps. In view of the fragmentary condition of the cloth, I am at a loss to say definitely whether this narrow ridge of wefts was inserted during weaving as a decoration, or is a neat darn worked with a needle (fig. 90, E). A darn may be seen in the lower right corner of the Anasazi twill cloth in figure 56.

Patching

Cloths too worn for darning were often patched. Various methods of securing the patch to the cloth are illustrated in figure 90, I–L. Running, twine, and hemming stitches were used. Ordinarily the raw edges of the patch were not turned under, but an exception was noted on a blanket from Gourd Cave (fig. 90, L).

Raw Edges

The raw edges of a torn or cut cloth might be reinforced in any of the ways illustrated in figure 91. Simplest of all was plain overcasting (A). Double overcasting was less commonly used. In this case one thread was probably put through, felt to be inadequate, and supplemented by a second (B). The edge was sometimes folded over and sewed down, generally with a hemming stitch, after which the fold itself was overcast (D). A fairly common and effective treatment was to roll a bit of the edge under and overcast the roll (F). In one case the roll was hemmed down, rather than overcast (E).

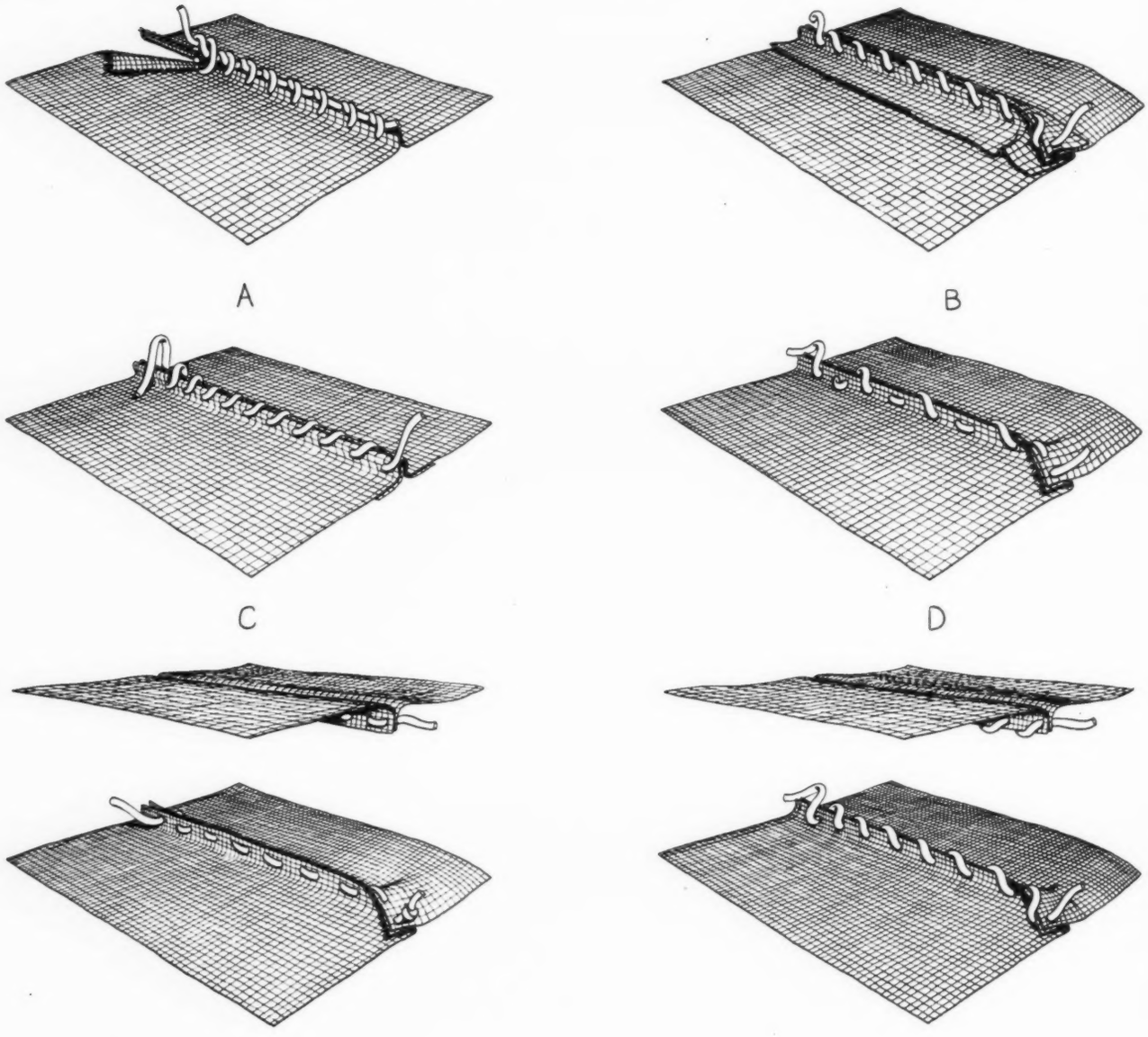


FIG. 92. Methods of sewing two cloths together.

An added device was used at Gourd Cave to reinforce a raw edge and discourage ravelling. A row of twine stitches was put through along the tear. Next the edge was overcast, or rolled and overcast (G, H, I).

Torn warp and weft edges of two cloths, one (PM A5057) from the Pueblo I burial in the Middle Tsegi described on page 491 and the other (NMSM Bc 34/1) from Chetro Ketl, were treated in the manner illustrated in figure 126, C. The free ends of warps and wefts were grouped by twos or threes and twisted together into loose threads. These threads were then twined along the edges of the woven cloth so as to resemble a regular selvage.

A buttonhole stitch was used in mending the frayed edge of a flat braid from Gourd Cave (fig. 91, C).

Seams and Tears

Ripped cloth might be sewed up in a number of ways, the most common practice being to use overcasting or saddler's (fig. 90, H) stitches. The mending of a tear in the Hidden House quiver is shown in figure 90, F. Rips in a cloth from Nitsie Canyon were sewed up with twine-stitching in a rather decorative manner (figs. 89; 90, G).

In making bags, quivers and ponchos similar techniques were used—saddler's, overcasting and running

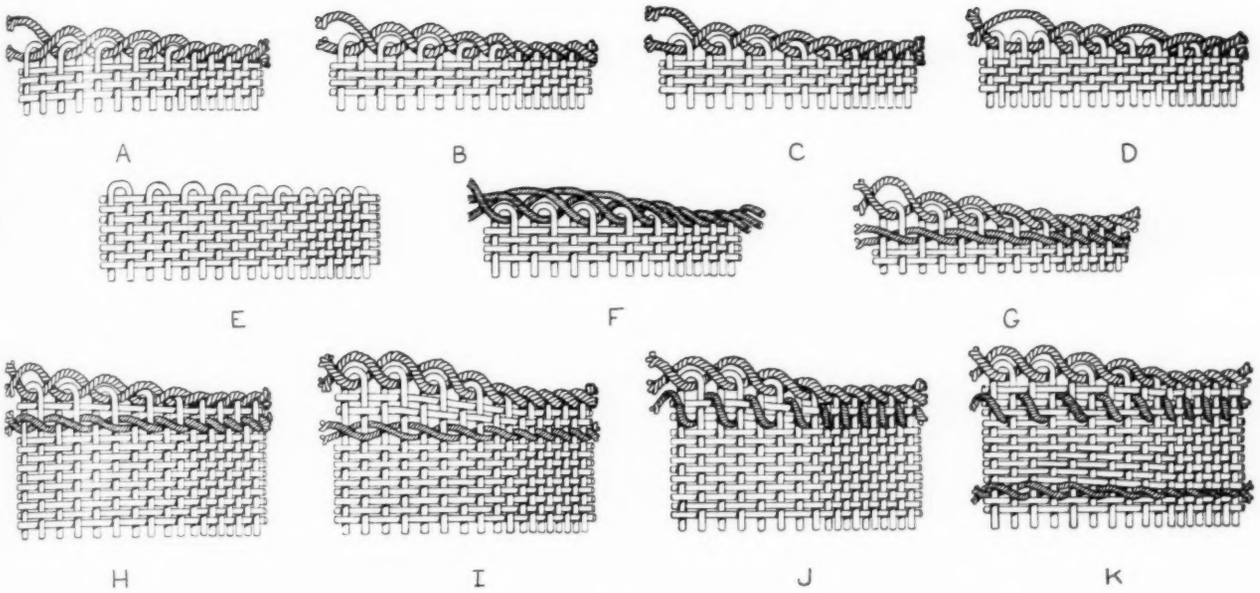


FIG. 93. Selvages.

A, B, C. Various methods of twining selvage strings between warp or weft threads.
D. The twining of selvage strings irregularly along a weft edge. Tonto. (NPS–T 9/545.)
E. The edge of a cloth with no extra selvage strings.
F. A three-thread selvage.
G, H, I. Selvages reinforced by rows of twine-stitch.
J, K. Selvages reinforced by outline stitch. Kiet Siel. (MNA 695/NA2519.M282 and NA2519.M281.)

stitches being most frequently found. More often than not the two cut cloths were put together and sewed up with no thought of turning in the raw edges (fig. 92).

2. *Finishing Techniques*

Selvages

The warp and weft edges of most loom-woven cloths were reinforced by extra strings. Weft edges of narrow tapestry weave articles and some ribbon-like warp-rep ties were not treated in this manner. In such cases the wefts simply turned around the edge warp and reentered the web. We have seen how the warp selvage strings were twined in at upper and lower edges of the proposed cloth during the stringing of the loom, and how extra strings were hung loosely at each edge of the web, to be incorporated as selvage threads by the weft as weaving proceeded (p. 485). In addition to the regular selvage strings, the edge of a cloth might be further reinforced by a row of stitching inside of the selvage, or by overcasting the selvage with an extra thread. Several ways of doing this are shown in figures 93 and 94. With one exception, it is the warp selvages that were so treated.

Reinforced selvages are especially typical of cloth from Kiet Siel, over half the total number of warp edges from that site being distinguished by this treatment. They are quite common on Nitsie Canyon material, and there are a few examples from sites in the Chinlee drainage. I have seen only two reinforced selvages from villages south of the Mogollon Rim—one from Montezuma Castle, and the other from Tonto—but they are reported also from Canyon Creek.[141]

Frequently a row of twine-stitching was inserted either just inside the selvage, or from one to three wefts in. It is possible that this was done before weaving commenced, or after the insertion of two or three wefts, as an aid in maintaining regular spaces between the warps (Fig. 93, G–I; 94, D, E, G). Two Kiet Siel selvages show outline stitches run in in similar manner. In one case the first two wefts next to the selvage were "whipped" tightly together, in the other the second and third wefts were so treated (fig. 93, J, K). Selvages from Canyon Creek are reinforced with a row of outline stitches one or two inches in from the edge, or with a row of running stitches immediately inside the edge. In one case the stitch shown in figure 92, A was used.[142]

Various techniques for binding selvages are illustrated in figure 94. *B* shows a unique four-thread selvage from Montezuma Castle, overcast with an extra two-ply thread. The warp edge illustrated in *D* was reinforced not only by twine-stitch, but also by overcasting. This is the end of a blanket, the neat overcasting having been extended a short distance down both weft selvages at the corners of the cloth. *F* illustrates the overcasting of selvage strings proper by an extra thread, and the additional application of a second,

[141] Haury, 1934: 91.
[142] Haury, 1934: 91, fig. 17, *e*.

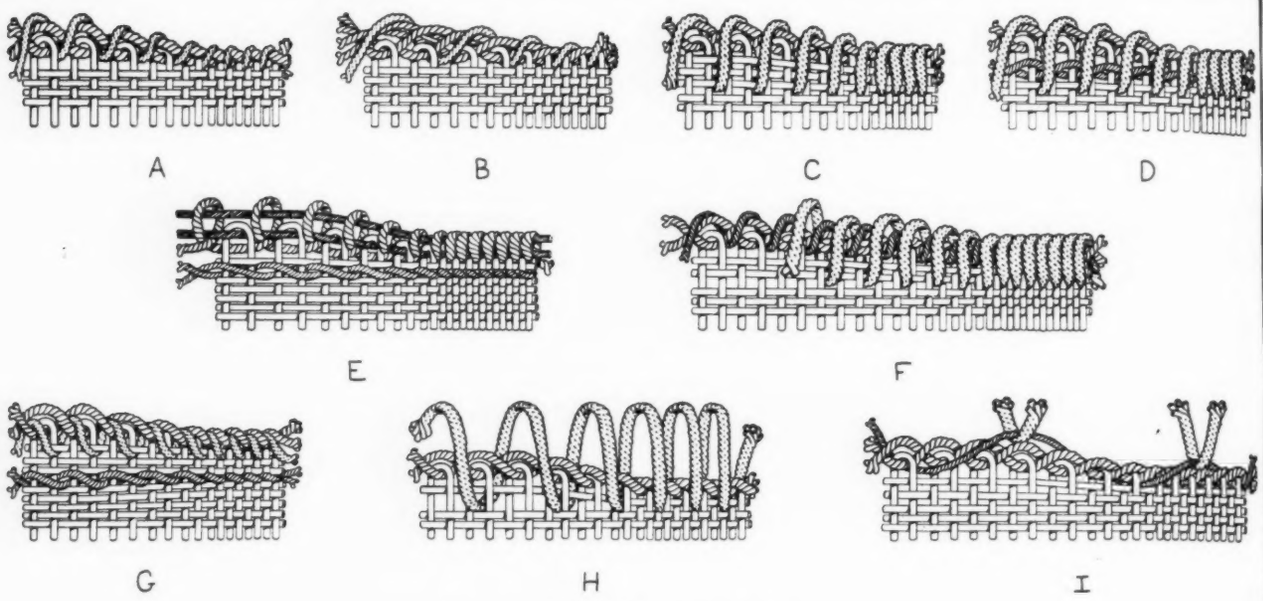


FIG. 94. Bound selvages and fringes.

A A two-thread selvage overcast with extra string. Floating House Ruin. (PM 33–62–10/2005.)
B. An unusual four-thread selvage overcast with extra string. Montezuma Castle. (NPS–MC 14.)
C. The selvage threads and three wefts overcast with close, vertical stitches in four-ply string. Nitsie Canyon. (ASM 2938.)
D. The selvage threads, twine-stitch and one weft thread overcast together. This overcasting is extended an inch down both weft edges at the sides of the cloth. Site unknown. (ASM 1107.)
E. Selvage reinforced by a form of buttonhole stitch. Kiet Siel. (MNA 695/NA2519.176.)
F. Selvage overcast with an extra thread. An additional soft, two-ply string then binds this and the first two wefts together. Kiet Siel. (MNA 695/NA2519.601.)
G. Forward selvage thread and first warp overcast together. Ford House Ruin. (PM A3319.)
H. Fringe on a narrow twill cloth. Six-ply string looped beneath selvage and first weft, extends $\frac{3}{4}$" beyond edge of cloth. Wupatki. (MNA 77/NA405.M235.)
I. The remains of what may have been a fringe. Tonto. (NPS–T 9/35.)

softer string over this and the first two wefts. Another variation is seen in *G*, wherein the forward member of the weft selvage threads and the first warp were overcast together. Three warps in is a row of twine-stitching in red. Apparently the decorative, as well as the practical, value of the stitchery was recognized. Reinforced by a sort of buttonhole stitch, the selvage from Kiet Siel illustrated in *E* presents another variation from the norm in that warps loop between two single-ply threads which are not twined together.

It is hard to say whether edges were bound before or after weaving the cloth. In cases where only the selvage strings are clasped, the binding could have been accomplished before weaving commenced, but if any wefts are included, it would seem that the ovecasting was applied after the cloth was removed from the loom.

It was apparently the custom to leave "borders" of plain weave from a few threads to an inch or so in width at the top and bottom of figured fragments such as twills, brocades, and weft-float pattern weaves. Weft-wrap fabrics sometimes have side, as well as end, borders of plain weave. The brown and white warp-float (?) fragments from Tonto described on pp. 531–532 may have had a separately woven border.

Fringes

There are only two good examples of fringing on loom-woven cloths.[143] The simplest is that along the warp edge of a narrow twill weave cloth from Wupatki, possibly the remains of a small bag, or a sash (MNA 77/NA405.M235; fig. 58, B). This fringe was made by passing a six-ply white cord regularly beneath the selvage and one weft, allowing it to hang in loose loops which extend about three-quarters of an inch from the edge of the material (fig. 94, H).

The more elaborate fringes on the ends of the tab of the Hidden House quiver are quite exceptional (fig. 41). There are minor variations between the two fringes, but essential features of their construction are the same. One is illustrated in figure 126, A, 5. The fringe is three-quarters of an inch long. It is composed of bundles of white string, each containing about twenty single-ply threads, hooked beneath the selvage and first weft. A four-ply thread, doubled and run through the fringe just outside the selvage, ties the bundles of strings in place.

The warp selvage of a fragment from Tonto (NPS-

[143] This does not include breech cloth fringes, which are considered with the discussion of those articles on pp. 609–613.

T 9/35; fig. 94, I) shows bits of five-ply cord passed beneath a string which loosely overcasts the selvage. This may be the remains of a fringe.

Corner Braids and Tassels

The corners of loom-woven cloth were generally finished off in some way, frequently by knotting the extra lengths of warp and weft selvage threads together, allowing the surplus to hang free as a sort of tassel (fig. 6, B, 3). Blanket and poncho corners were often more elaborately treated. Crude balls were fashioned at the corners of a Vandal Cave blanket by winding the free ends of the selvage strings together and tying them in place (fig. 6, B, 2). Sometimes the free-hanging strings were worked together into flat, square, or round braids from one to three inches long (fig. 6, B, 1). In making round and square braids the four selvage strings were supplemented with additional threads looped between them at the start end of the braid, or passed through the corner of the cloth. The threads were tied off in pairs in square knots at the end of the braid.

Square corner braids on the tie-dye blanket from Lake Canyon (figs. 83, 95) are especially noteworthy. Each is made from eight multiple-ply white strings (there are about ten plies per string) which are looped beneath the selvages at the corners of the brown cloth. At the free end of each braid is a pompom, or soft ball. Such pompoms appear at the lower corners of the Painted Cave poncho (fig. 84), and are commonly found on the fringes of braided ties and sashes. They were made by looping bits of soft, thick cotton thread beneath the tied off braid strings, or beneath an extra string wrapped about the end of the braid (figs. 105, C, F, 107, G). These threads were packed closely together and then cut off to a uniform length so that their ends formed a soft, round ball, generally about one inch in diameter.

FIG. 95. Corner braid on the tie-dye blanket from Lake Canyon. (UM 29.43.183. Photo by Taylor Museum.)

A Comparison of Prehistoric and Modern Sewing and Finishing Techniques

I have no information on darning and patching methods among contemporary Pueblo Indians. As in the old days, articles are woven to shape on the loom. The only garment calling for a knowledge of sewing as distinct from weaving is the man's shirt. The rectangular sleeves, woven separately, must be sewed to the body of the shirt, and the raw edges of the neck hole turned under or overcast.

Contemporary selvages are identical in construction to the ordinary prehistoric ones. I have not seen bound edges on modern pieces.

Blanket corners today are usually finished by knotting selvage threads and then twisting them together. There are tassels at the corners of some embroidered blankets, shirts and the white Hopi wedding robes.[144] Generally quite large and fluffy, they resemble the elaborate tassels shown in the Jeddito murals rather than the simple corner braids and pompoms of Pueblo III and early IV described above. The similarity between the large tassels at the lower edges of Hopi wedding robes and certain of the mural illustrations is especially striking.[145] There is but one prehistoric example of the "rings" which are so characteristic a feature of the flat braided Pueblo wedding sashes today. This comes from Bear Creek Cave (see p. 597).

PART II. NON-LOOM FABRICS HAVING WARPS AND WEFTS

INTRODUCTION

There are three finger-weave techniques (in addition to non-loom tapestries) which make use of distinct warps and wefts. They are not loom processes, since they do not involve the use of heddles. It is not even known for sure whether the warps were held tight between two rods, as in loom-weaving, or were free-hanging as in most plaiting and braiding. The techniques in question are warp-twine, weft-twine, and weaving on a cylinder of warps.

COUNTERPAIRED WARP-TWINE

Definitions

In *warp-twine* two adjacent warps are twisted a half-turn about each other between each pick of weft.

Counterpairing. In twining or weaving the turning

[144] Douglas, 1939*c*: 161 and 1940*a*: 166.

[145] Nequatewa, 1933.

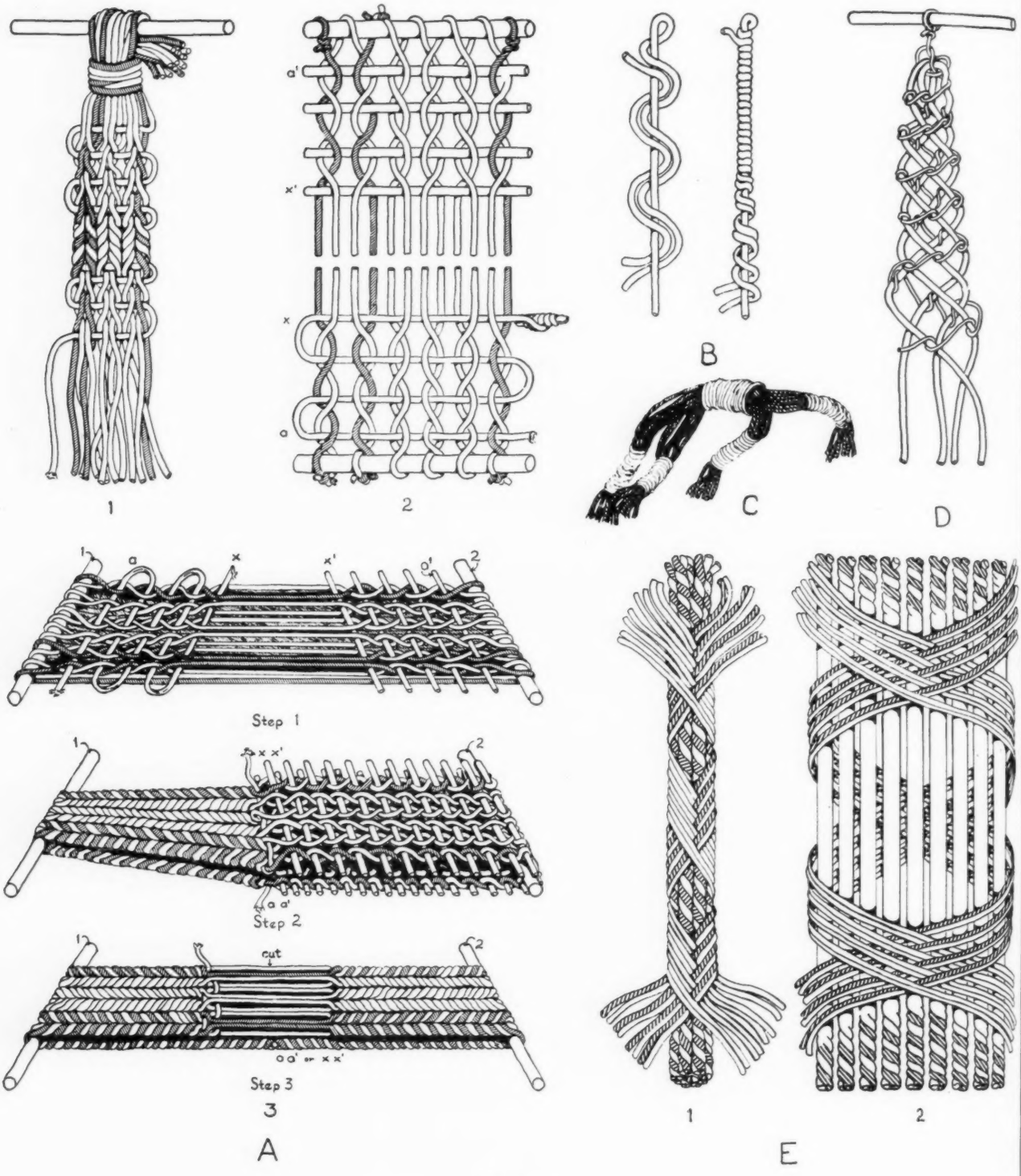


FIG. 96.

A. Three methods by which the counterpaired warp-twine tie from Tonto could have been woven. (NPS–T 9/600.) (1) Free-hanging warps. (2) Warps anchored between two sticks. (3) Warps passed continuously around two end rollers.
B. A wrapped cord from Kiet Siel. (MNA 695/NA2519.287.)
C. Small segment of ornamental cord from Montezuma Castle. (NPS–MC 47.)
D. One method of making a net-like cylinder of the type found by Cosgrove in Mule Creek Cave. (Cosgrove, 1947: 122–123.)
E. Ornamental brown and white cord made by braiding around a core of nine two-ply strings. Tonto. (NPS–T R16–15.)

of the two elements of adjacent pairs toward or away from each other, thereby forming a plaited effect, is called "counterpairing." [146]

Technical Description

Unique in the series is a narrow tie, or ribbon, less than half an inch wide, and nearly 20 inches long in its present incomplete condition. It is from Tonto (NPS–T 9/600). There are twelve warps, nine white and three dark blue. All wefts are white. When the twist of the first pair of warps is towards the left, the twist of the second pair is towards the right, that of the third towards the left again, and so on. This method of handling warps, called "counterpairing," creates a pattern of chevrons (fig. 96, A).

The weave of this tie can be reproduced in a number of ways.[147] If it were complete we could perhaps determine which method was actually used prehistorically. As it is, we cannot be sure. Three processes worked out in the laboratory are described below:

Method 1. Twining with free-hanging warps (fig. 96, A, 1)

The warps are fastened at one point and the weft worked in from that point downward. Pairs of warps are twined a half-turn about each other with the fingers of both hands. Those threads under which the weft is to pass are then held forward in one hand while the weft is put through with the other. The process is simple, and the ribbon grows rapidly.

Method 2. Warps anchored between two sticks (fig. 96, A, 2)

In this method, warps are anchored between two sticks, but lie on one plane rather than being handled as a continuous tube or "roller." The sticks may be upper and lower loom bar, or may lie horizontal to the ground as in Method 3. Twining is done from one stick towards the other, inserting retaining rods and pushing them to upper loom bar or opposite end. When the warp is filled with weft and rods, the latter may be removed one by one and replaced with wefts as in Method 3, working either from the opposite stick towards the center, or from the center out.

Method 3. Warp threads passed continuously around two small sticks (fig. 96, A, 3)

In Method 3 warp threads are passed continuously around two small sticks, and lie parallel to the ground. This process resembles that of braiding on a frame mentioned on page 602. Starting at one end roller, which we will call stick 1, twine the warp pairs about each other with the fingers, working from right to left. Insert the weft (a), and in the *same shed* place a small retaining rod (a') and push it away from yourself towards the other end roller, or stick 2. Next twine the warp pairs working from left to right. Put the weft through and insert a second retaining rod. Push the latter away from yourself to the first retaining stick. Repeat these steps, gradually pushing the rods over end stick 2 and clear around through the warps until the first one inserted backs up against the first weft pick. As weaving progresses the warps may be pulled, roller towel fashion, over the end sticks so that the working area is kept within easy reach of the weaver. The end sticks must be moved closer together from time to time, as the warp length is reduced by the twisting. Finally the entire stretch of warps will be filled with weft and rods, as shown in Step 2, the last weft pick and rod being indicated as x and x'. Now the rods can be replaced by wefts in either of two ways:

(a) After x, insert one more pick of weft, but *no* retaining rod. Now replace x' and each succeeding rod with a weft pick until all rods have been removed.

(b) Take up a position at end roller 2. Pull warps around rollers until a and a' are on the upper plane of warps at 2. Replace retaining rods with wefts starting with a' and working through x'.

When the rods have been removed the piece may be taken from the rollers by cutting through the unwoven stretch of warps (Step 3). The result is a narrow ribbon with free-hanging threads at each end which may be twisted or braided into a fringe.

Both methods 2 and 3 take advantage of the fact that as you twine the warps at one end you automatically twine them at the other end, too. If you preserve this second twist by holding it with a retaining rod, your tie "grows" twice as fast. In both cases there will be a point at the middle of the tie where the twist of the warps reverses direction. This marks the place where the retaining rods and wefts met, either point a–a' or x–x' in figure 96, A, Method 3, Step 2. Starting at this line the rods were replaced by weft threads. In using any of the three methods, the weft is pulled tight after being inserted, thus forcing warps close together.

Narrow warp-twine bands, less than half an inch wide, woven of human hair and apocynum (?) string are reported from two Basketmaker sites in the Kayenta area.[148]

Some examples of warp-twine are to be found among Peruvian textiles. O'Neale mentions narrow, all wool, warp-twine bands in the Early Nazca collections, and larger warp-twine fabrics from Paracas Caverns graves.[149] She describes one of the latter pieces as having heavy loomstrings at either end, and a ridge at mid-

[146] O'Neale, 1937: 215.

[147] I have been told by Miss Irene Emery that, in addition to the techniques described below, the tie could have been woven by a process called "tablet weaving," which is widespread in the Old World but has not been identified in New World material.

[148] Kidder and Guernsey, 1919: 173–174, fig. 82. Guernsey, 1921: 76.

[149] O'Neale, 1937: 196–198.

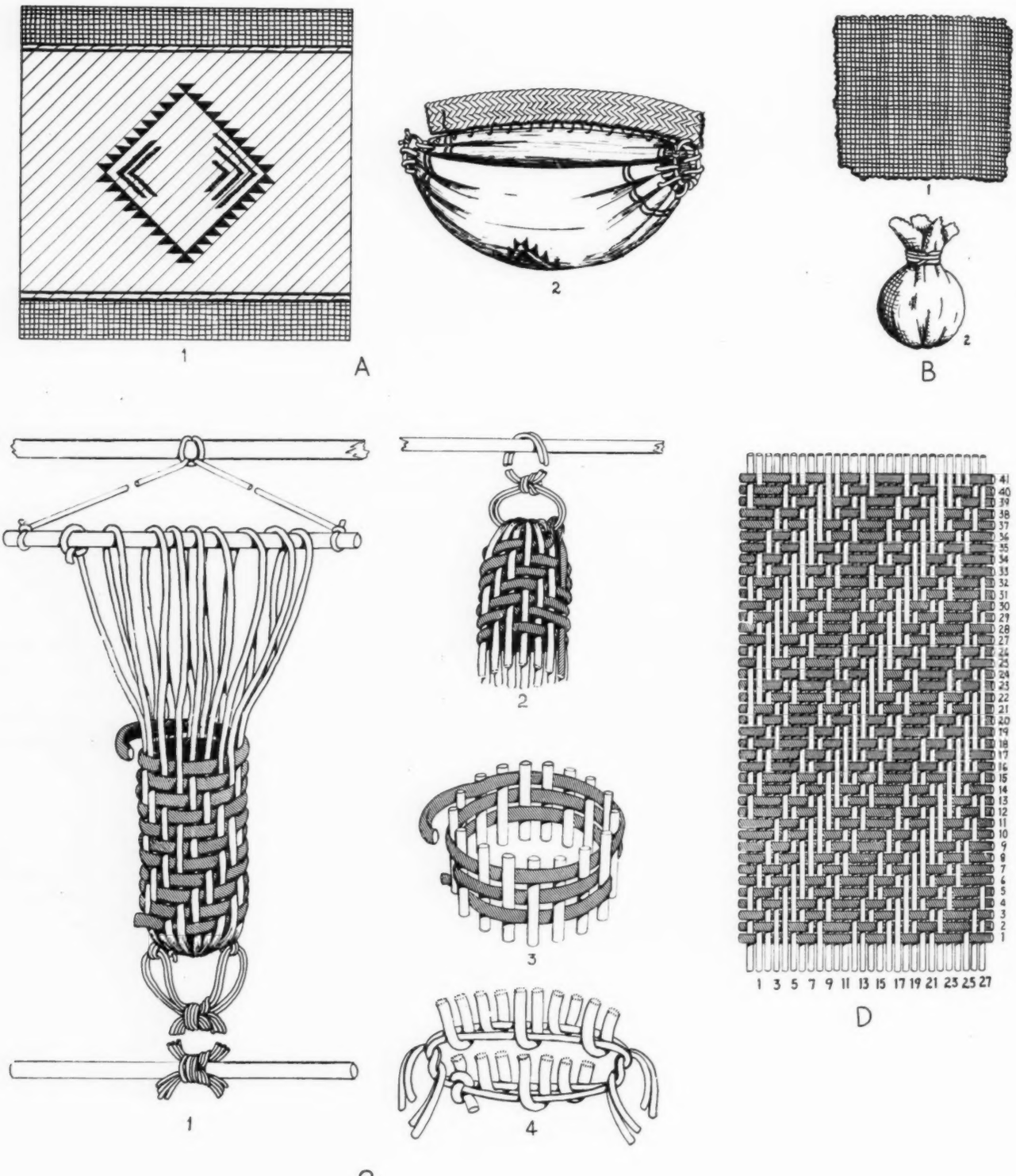


FIG. 97.

point from which the pattern and ground meshes diverge in opposite directions. In other words, it looks as though the weave had been done with warps anchored at both ends, as in our Method 2 or 3 above.

WEFT-TWINE

Definition

In this weave wefts are used in pairs. They clasp one or more warps at a time, make a half-turn about each other, and then clasp the next warp or warp set.

Technical Description

I have seen six Pueblo III bands woven after the manner of Basketmaker bags, the wefts being twined among the warps in pairs. Three others are mentioned in the literature (see Appendix C, chart 10, *a*; fig. 6, D). Indistinguishable from plain or twill weave tapestry bands at first glance, all contain yucca (?) fiber warps and cotton wefts. The three complete examples are between 18 and 20 inches long and 2 to 3 inches wide. Two have loops at both ends. A third has a loop at one end, while warps are knotted together at the other. All are thought to be tump lines, or carrying bands, with the possible exception of one (USNM 254.848) which is but half an inch wide. This is decorated by narrow weft stripes of yucca twined in every three-quarters of an inch. One of the broader bands has five similar weft stripes near its center (USNM 257.360).

In most the bands weft pairs enclose a single warp before twisting about each other (fig. 6, D, 1). Kidder and Guernsey describe a tump line from Waterfall Ruin (PM A–1655) wherein weft pairs clasp two warps at a time, in the following manner:

> It is 19 inches in length, 2½ inches wide. The weft is cotton cord; 24 to 26 yucca strings form the warp. The weft is inserted by twined weaving; a twilled or diagonal effect is produced by inclosing two warp strands, the order of their inclosure being varied from one series to the next. The loops at the ends are made by gathering a number of warp strands into two rolls, which are strengthened and held together by a continuous figure 8 weaving of cotton cord.[150]

Weft-twine as a basketry technique is done with the warps hanging free from one support, while the wefts are twined in from that point downward. Some tump lines may have been made in this manner, but judging from the end loops, most were woven on a skein of warps strung between two supports as for the tapestry bands described on pages 524–529.

Distribution and History of Weft-twine

The nine examples of tump lines with twined wefts of cotton come from Canyon del Muerto, Mesa Verde, Waterfall Ruin, and Tsegi-ot-sosi, and are probably all Pueblo III in date. Weft-twine was an important technique among the Basketmaker for weaving flexible containers, and was also used by them in making rabbit fur blankets and tump lines like those just described. It was their custom to use tough yucca fiber for the warps and softer apocynum (?) thread for wefts of their bands. After the introduction of cotton, that fiber was sometimes substituted for apocynum. Which material was used depended, probably, on which was more plentiful in a given village. My information is by no means complete on this point, but it does appear that by Pueblo III cotton had pretty generally replaced apocynum as weftage.

The technique of weft-twine was not confined to the San Juan area. It is reported also from McEuen Cave (date unknown), Ventana Cave (1000–1400) and southeastern New Mexico (Basketmaker ?).[151] However, its application to narrow band weaving and the use of cotton in weft-twining has so far been noted only among the Anasazi.

WEAVING ON A CYLINDER OF WARPS

The collections include remains of six small cotton sacks (Appendix C, chart 10, *c*) shaped like the fingers of a glove. Three come from Tonto and three from Cave I (Sunflower Cave), Kinboko or "House Canyon," a narrow gorge entering Marsh Pass from the west. Although the Marsh Pass sacks are somewhat larger and woven of coarser thread than those from the southern site, all are constructed in the same fashion. Each of the six is a seamless, cylindrical object, with the warps running lengthwise of the cylinder and held in position by a continuous weft which is woven around and around through them in a twill or weft-float pattern weave.

The Tonto sacks are black, apparently as a result of charring rather than of dye. Two (NPS–T 9/60,

FIG. 97.

A. Twill weave cloth with a brocaded weft-float center design and plain weave warp borders. Grand Gulch. (AMNH H/14400.) (1) The cloth, 13¼″ square, showing all that remains of the weft-float design, worked in black wefts. (2) Method of gathering the cloth at its ends and sewing one edge to a flat braid. Presumably the braid once extended along the other edge and the cloth was thus fashioned into a bag.

B. Method of making small bags from a scrap of cloth. (1) The cloth, about 2″ square. (2) The bag, made by drawing the corners of the cloth up around small objects placed upon it. The corners are held together by a string wrapped tightly around the cloth below them.

C. The construction of small sacks made by weaving on a cylinder of warps. (1) One method by which the sacks may have been woven. In this the warps are fastened at both ends and the weft worked in from the bottom up. (2) A second possible set-up for cylindrical warp weave, the warps being free-hanging, and the weft carried through them from the top down. (3) Detail showing how wefts were worked through the warps in over-two under-two twill rhythm. (4) Detail of warp loops at the bottom of a Tonto sack.

D. The weft-float rhythm in a cylindrical sack from Marsh Pass. (Kidder and Guernsey, 1919: 147–150, fig. 67 and pl. 62, *a*, *b*, *c*.)

[150] Kidder and Guernsey, 1919: 117. See our fig. 6, D, 2.

[151] Cosgrove, 1947: 70–71. Haury *et al.*, 1950: 410, 457.

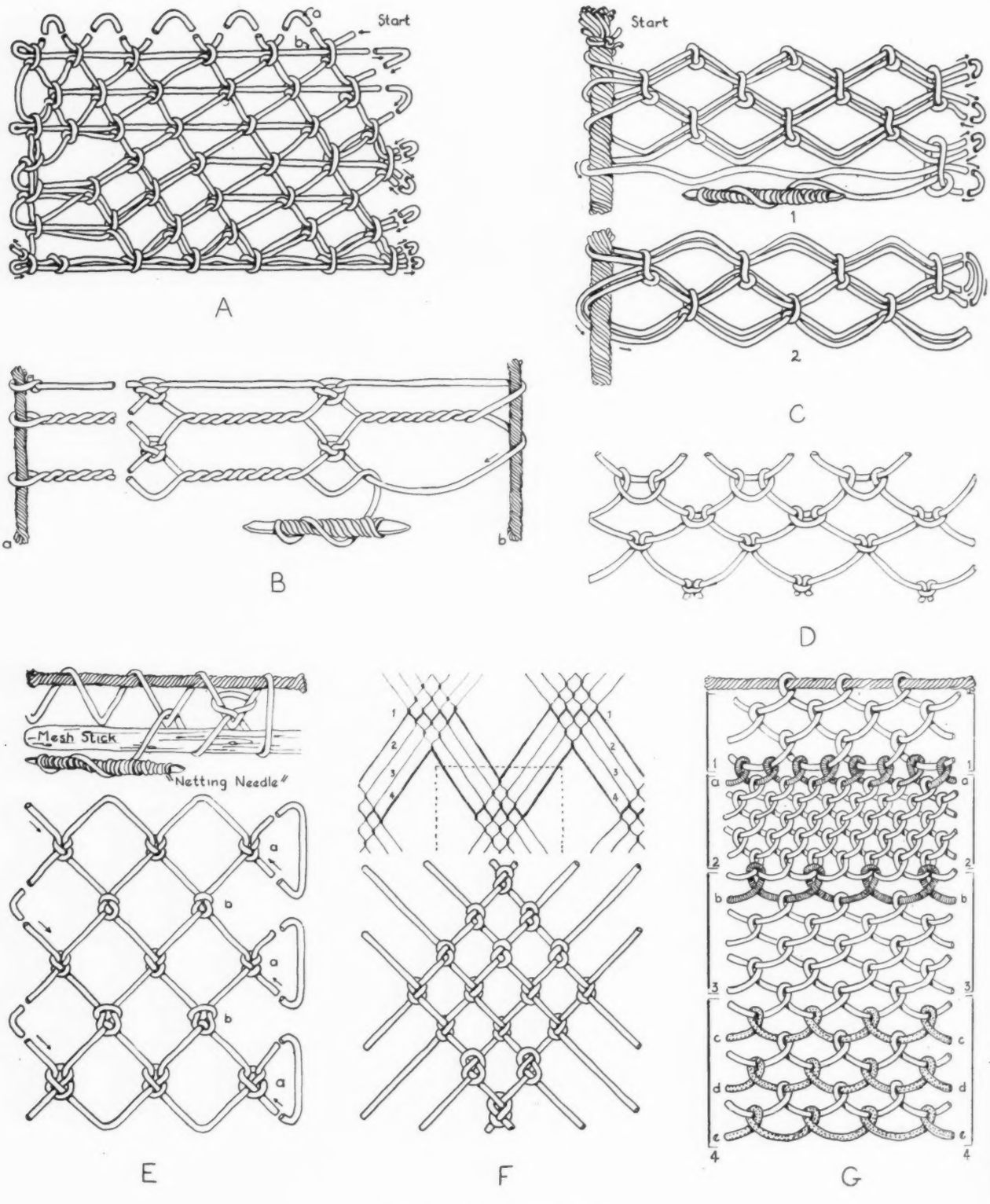


FIG. 98. Looping techniques.

9/61) are woven of single-ply warp and weft threads. Wefts pass over-three under-three warps to make a reversed twill pattern. The larger of the two sacks (9/61) is about an inch in width by five inches in length. (The length of all three is incomplete.) The third sack (9/62), patterned in over-two under-two reversed twill, is about three quarters of an inch in width by three and a half inches in length. Warps are single-ply. The two-ply thread used for weftage was loosely twisted. The plies have separated so as to give the impression of being paired threads. Irregularities in the twill rhythm of all three sacks appear to be the result of errors in weaving.

The sacks from Marsh Pass are in poor condition. They were originally about five inches long by two inches wide. Warps are two-ply white thread; wefts two-ply black. Kidder and Guernsey have analyzed the complex weft-float rhythm in the best preserved of the three. Our drawing (fig. 97, D) and the following explanation of it are based on their findings.[152]

The weft is inserted according to the rhythm followed by our weft number one from warps number 1 through 27, or:

> under-5, over-2, *under-1, over-3, under-2,* over-2, under-2, over-2, *under-2, over-3, under-1,* over-2, and repeat.

The weft is drawn through a total of twenty-seven warps before recommencing the rhythm by floating under five warps. The two points at which a weft floats over three warps are in italics. Notice that in the first instance the weft floats *under-one,* over-three, *under-two* warps, while in the second instance it floats first *under-two,* then over-three, then *under-one* warp. This is important to the design. At the points where odd-numbered wefts on our drawing pass *under-one, over-three, under-two,* even-numbered wefts pass *under-two, over-three, under-one,* and *vice versa.* This is simply because each even-numbered weft commences the established rhythm fourteen warps to the right of the odd-numbered weft below it. On our drawing, weft number 1 floats under five warps beginning with warp number 1, while weft number 2 floats under five beginning with warp number 15.

We have been speaking of "weft number 1," "weft number 2," etc., as though there was a series of wefts inserted one above the other as in loom weaving. Earlier in the discussion we pointed out that all the sacks are cylindrical, with a single weft thread moving around and around a column of warps. In point of fact, then, we have but one thread, and must determine how it happens that this passes under-one, over-three, under-two at a given point on its first course around the column of warps and under-two, over-three, under one at the same point on its second course, and so alternates the order of these float sets with each successive course. This will occur automatically if the number of warps in the cylinder is correct. There must be enough warps so that the weft, starting with a warp arbitrarily numbered *one,* is allowed to complete one or more full rhythm sets requiring twenty-seven warps each, plus the first thirteen warps of another rhythm set. (The minimum number of warps that will serve the purpose is forty.) This done, the weft will have returned to warp number 1. With no break in the rhythm it starts its passage around the cylinder of warps again. This means that in the second weft course warp number 1 is the fourteenth in a rhythm set instead of the first. When the weft has completed its second passage around the column of warps it is in a position to start a new rhythm set one warp to the right of number one.

The weaving of forty-one weft courses on a foundation of twenty-seven warps is shown in figure 97, D. We do not know how many warps there really are in the sack itself, but since it is about 4 inches around, and there are approximately twenty-two threads to the inch, we can figure the total number of warps as about eighty-eight. The closest number to this which would have served for the weave is ninety-four. This would allow the weft to complete three rhythm sets of twenty-seven warp threads (requiring eighty-one warps in all), plus thirteen warps of the next rhythm set.

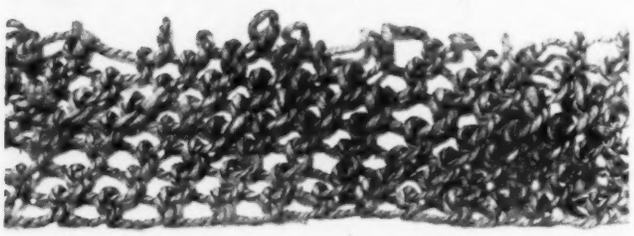
The pattern as described so far is like plain twill in that the lines of weft-float all extend up the cloth in one direction. According to Kidder and Guernsey (p. 150) at another point in the weave: "Some change in the arrangement of the rows seems to throw the pattern in the other diagonal direction, and there are some indications that the design as a whole was made up of diamond-shaped figures."

Two methods by which the little sacks could have been woven were worked out experimentally. In one (fig. 97, C, 1) the warps were strung tubular fashion between a small stick and a cord. The cord, at the bottom edge of the warps, was fastened to the lower loom bar so as to leave about two inches between it and the warps. The small stick was suspended from the upper loom bar by long strings. The weft was carried

[152] Kidder and Guernsey, 1919: 147–150, fig. 67 and pl. 62, *a, b,* and *c.*

FIG. 98.

A. An overhand knot used in netting. McEuen Cave. (GP #117.)
B. The construction of a large net from McEuen Cave. (GP #118.)
C. Two possible methods of manufacturing a net with overhand knots. McEuen Cave. (GP #116.)
D. A segment of netting done with a "lark's head" knot. Tularosa Cave. (Martin *et al.,* 1952: 302.)
E. Method of manufacturing a net with the regulation netting knot.
F. The grouping of knots into decorative diamonds in a net from McEuen Cave. (GP #119.)
G. Details of the closed loop technique, showing how loops may be increased (*a*) or decreased (*b*).



A

B

FIG. 99. A. Closed loop fabric of multiple-ply cotton string with brown animal hairs twined in it. Gourd Cave. (ASM 3448.) B. Close-up of twine-plaiting in the shirt from Tonto Monument. (ASM 13400.) (Photos by E. B. Sayles.)

across the front plane of warps, then the entire rig was turned, bringing the back plane of warps forward, and the weft was passed through them. By this process the space between front and back warp planes became the inside of a cylindrical bag.

A second method is illustrated in figure 97, C, 2. Warps were simply tied together at their centers and fastened to the upper loom bar, with their ends hanging free. The strands were separated into two planes and held thus in the left hand while a single thread was woven through them from the top down. This technique, closely allied to braiding, is employed by certain of the Great Lakes Indian tribes.[153] The twill rhythms of the Tonto sacks were easily duplicated in this fashion, but it was almost impossible to keep warps in position for the complex weft-float pattern weave. A person skilled in the technique probably would not have experienced this difficulty.

Without more definite knowledge of the construction of mouth openings of the sacks we cannot really tell which method was used. According to Kidder and Guernsey (p. 149) the material at the mouths of the Marsh Pass sacks was: "Turned in and sewed down to form tunnels for the heavy, round drawstrings, which were neatly braided of many strands." Rims of the Tonto sacks are all missing.

A number of tiny black stone beads were found with the Marsh Pass sacks. One bead was sewed to a bit of weft-float cloth which may have been part of a sack. It is felt that all three bags may originally have been decorated in this manner.

The Tonto sacks were filled only with dirt when I saw them, and there is no indication of the use for which they were intended. However, they probably served the same function as their Anasazi counterparts, which was to hold small objects apparently of a ceremonial nature. The Marsh Pass sacks were among articles cached in a small black and white jar which had been covered by a large sherd and buried near the back wall of the cave. They held small leather paint sacks, shell beads, bundles of herbs, squash seeds, a lump of rough turquoise, iron pyrites, malachite, a cylinder of manganese ore, turquoise pendants, minute black stone beads, and many other items.

In my opinion the making of little sacks like this was probably a pre-loom, pre-cotton tradition widespread in the Southwest. I would guess that the weave was accomplished with free-hanging warps of yucca, apocynum, or maybe human hair. Nothing of the sort has been described for the Basketmaker, so this remains no more than a conjecture. Small twined-weft bags of the same size and shape were found in Basketmaker II sites in northeastern Arizona.[154]

PART III. FABRICS MADE UP OF SINGLE ELEMENTS

INTRODUCTION

Cotton was sometimes used in the manufacture of fabrics which do not contain distinct wefts interwoven with stationary warps, but consist of single lengths of thread interlaced with one another. Certain of these, as braiding, twine-plaiting, and cordage were made by fastening one end of all the threads at a given point, or along a given plane, and interworking them from that point or plane downward. Others, as looping and netting, were made with threads horizontal to the ground, in the position of wefts. Each thread was added to that above it by being looped along it or knotted to it.

It seems evident that all these finger processes were current in some form or another long before the invention of warp-weft weaving, the loom, or the use of cotton. In the Southwest, examples of looping, netting, cordage, and braiding in human hair, animal wool, and coarse plant fibers come from Basketmaker sites. Only twine-plaiting has not so far been reported from pre-cotton horizons.

[153] This information comes from Miss Mable Morrow, a former Indian Service employee with a wide knowledge of current Indian weaving and braiding processes.

[154] Guernsey and Kidder, 1921: pl. 30. Kidder and Guernsey, 1919: pl. 79.

LOOPED FABRICS

Introduction

Textiles in this class are composed of a continuous series of interlocking loops. The first row of loops is made by a length of thread passed along a stick or string. The fabric grows as successive rows are added by drawing new lengths of thread through the loops formed in the preceding course. Our discussion includes three varieties of looped fabrics: closed loop, looping over foundation cords, and netting.

1. *Closed Loop*

Definition

The process whereby the thread is crossed on itself after encircling the loop above it, is called closed looping.

Technical Description

This technique has been described under several names. It is the same as "coil without foundation," a term coined by Mason, who was thinking of it as a basketry process. Willoughby, recognizing its close relationship to netting, suggested the name "coiled netting," which was used by Guernsey and Kidder in their 1921 publication. The Cosgroves, amended this to read "*plain* coiled netting," thus distinguishing the simple process described here from slightly more complex forms. Amsden referred to it quite simply as "looping," and Davidson identified it as a form of knotless netting called "simple loop." Emery joins these two authors in classifying it as a looping technique, using the specific term "closed loop" to distinguish it from other related processes. She includes netting in the same category, defining it as a looped fabric in which the thread is knotted on itself after passing through the mesh above it. We are following her classifications.[155] There are thirteen examples of closed loop *cotton* fabrics in the collections studied (see chart 11). In addition to these, there is a bag from McEuen Cave fashioned from a string made of human hair cord and cotton rag strips knotted together.[156]

FIG. 101. Closed loop shoe-sock. Plaited yucca leaf sole. Multiple-ply cotton and wool string upper. Length of sole, 11½". Two Mummy Ruin, Nitsie Canyon. (ASM 1026. Photo by E. B. Sayles.)

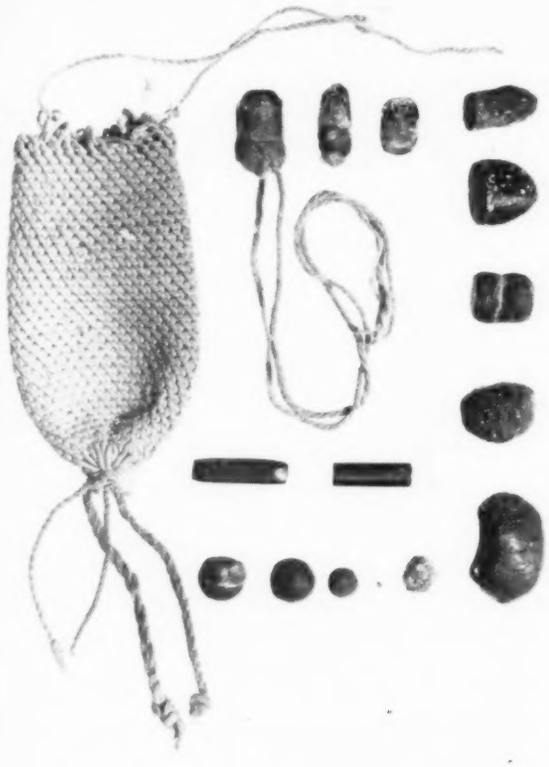


FIG. 100. Closed loop medicine bag and contents. Gourd Cave. Length, without "tassel," 3½". (ASM 1983. Photo by E. B. Sayles.)

In looping, the first step, as we have said, is to run a length of string along a cord or a stick parallel to the

[155] Amsden, 1949: 4. Cosgrove, 1947: 71–73. Davidson, 1935: 117–134. Guernsey and Kidder, 1921: 77. Mason, 1904: 247–248. Miss Emery's terminology for this and other single element techniques was given me by her in conversations in 1953.

[156] Kelley, n.d.: 13.

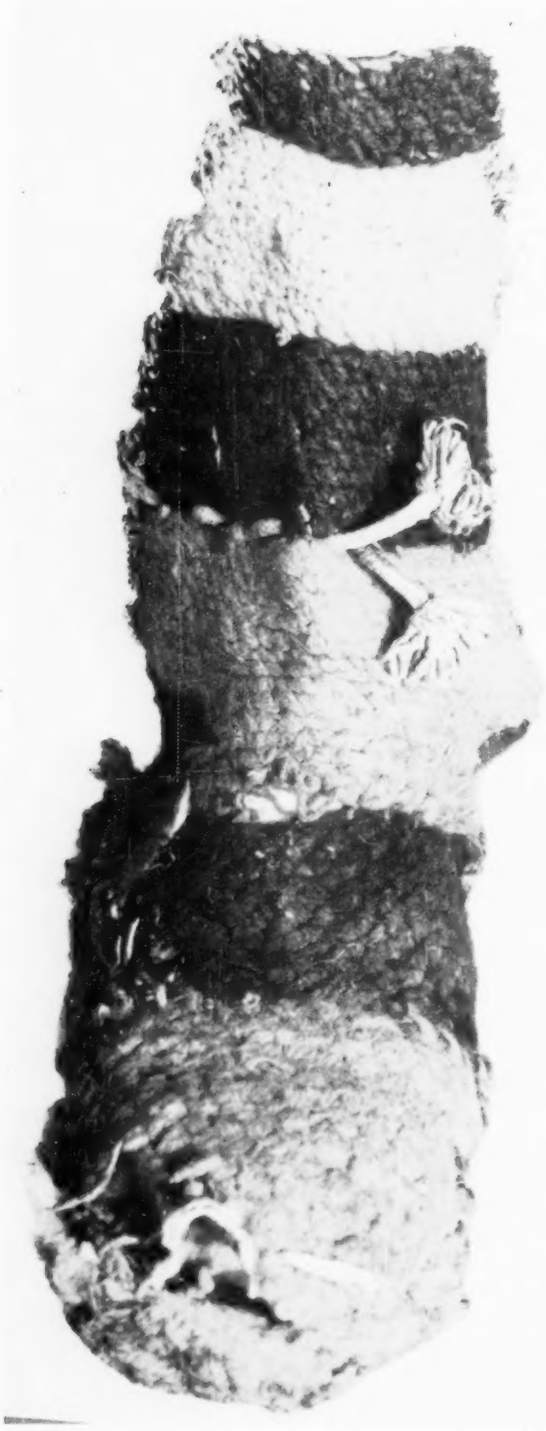


FIG. 102. Closed loop shoe-sock. Multiple-ply cotton string twisted with light and dark animal hair. Ankle tie is square cotton braid with pompoms at ends. Heel to upper edge, $9\frac{3}{4}$". Gourd Cave. (ASM 2768. Photo by E. B. Sayles.)

ground. The cord may be fastened between two supports, or, for small articles, simply held between the fingers of one hand while looping is done with the other. If a fabric with right and left edges is to be made, the length of string may pass from left to right along the cord, then be carried back from right to left, and so forth. Or a row of meshes may be made from right to left, the fabric turned over and a second row of meshes made. By this method all looping will be done with the thread carried from right to left. This is the case in most regular knotted netting. Slight variations between rows of loops on some fabrics are probably due to the fact that the thread was manipulated in one way when passing to the right, and in another when passing to the left. It is impossible to tell from looking at a finished piece in which direction the thread was being carried. However, all loops in parts 1, 2 and 3 of figure 98, G were probably made in the same manner (I would say working from right to left, although they can equally well be done from the other direction), while *c*, *d* and *e* in part 4 of the same figure, were made with thread moving in the opposite direction (see also fig. 99, A).

Judging from the closed loop fabrics in our collections, the technique was generally used for making circular articles, such as socks and bags (figs. 100–102). In the case of bags, the edge cord was doubled on itself so as to form a circle, around which the string looped continuously. When the string reached its own start end, a second row of loops was commenced, and so the bag was fashioned, without need for cutting or seaming. The dimensions of the piece could be increased at any given point by adding to the number of loops in the circumference of the bag. This was done by looping the string twice through the mesh above it instead of once (fig. 98, G, *a*). In decreasing the size of the article, the number of loops had to be lessened. In this case the string was made to include two loops in a single coil. This was done by passing it from behind through the second of the two loops, then back over the twist between the loops and through the first of the pair from the front (fig. 98, G, *b*). A mesh gauge, such as that generally used in regular netting (fig. 98, E), may have been used in closed looping, but in my experiments with the technique I found it a hindrance rather than an aid. In making a very fine mesh, I found it helpful to keep a small, pointed stick in my right hand, with which to poke the end of the string through the tight loops.[157]

[157] A small closed loop cotton string bag may be made in the following manner: Take a cord about six inches long and knot to it near one end a string of any manageable length. Mine was about eight feet long. I used parcel post string, which is nearly $\frac{1}{8}$ inch in diameter. Make a loop around the cord with the string. I did this by holding edge cord and string where they were knotted together between the thumb and ring finger of the left hand, pulling the edge cord taut by holding it an inch or so to the right of the knot between the index and middle finger of the same hand. It proved easier for me to work from left to right. Then I looped the string around the cord from front to back and through itself, pulling the free end through with the right hand. The loop made is shown in *c*, *d* and *e*, figure 98, G, part 4. The left hand must now move to the right to hold the loop in place while a second one is made. After two or three inches of loops are fashioned along the cord, fold it

The upper portions of shoe-socks were fashioned by looping the string around the edges of a sandal sole, and "building" the sock from there by adding successive rows of meshes. The loops were easily manipulated to form a fabric shaped like a sock, in much the same manner as stitches are added or "dropped" while knitting a sock with needles. Looping was commenced at the toe, and the thread was passed from side to side of the sole, the number of meshes being increased to shape the sock over the instep. The toe portion of the sock thus fashioned extended to about the mid-point of the sole. Loops were now made around the edge of the sole from one side of the toe section to the other, and meshes added until the heel was built up (fig. 6, C). The foot of the sock was completed up to the ankle, from which point the leg of the sock was built up. (This analysis is based on a complete shoe-sock from Two Mummy Ruin, Nitsie Canyon, ASM 1026.)

The type of cotton string used in closed looping depended on the article being made. Shoe-sock uppers were of four- to six-ply cotton with animal hairs twisted between the plies (fig. 6, A, 6; p. 478). Bags (and quiver tips) were made from finer two- or three-ply threads.

The Distribution and History of Closed Loop

I find no references to closed loop fabrics *in cotton* aside from the thirteen listed in this report. Twelve of these are from Anasazi sites, probably all Pueblo III in time. There are pieces from White House, Kiet Siel, Gourd Cave, Two Mummy Ruin, the Kayenta area and "Navaho Monument." The thirteenth closed loop cotton fabric is from Hidden House. Six of the examples are socks or sock fragments, being worked in coarse cotton-and-animal hair string. Three are bags and one is the bottom of the quiver described on page 625. The remaining three specimens are fragments unidentifiable to use. One, from White House, has what may be feathers twisted between the plies of the cotton string.

There can be no doubt that looping has a venerable history in the New World, having been in use long before the loom or cotton. It is still widely practiced, as both Mason and Davidson point out.[158] In the Southwest proper, at least among the Anasazi, it seems to have been used basically in the manufacture of footgear and bags, both by Basketmaker and Pueblo peoples. Some examples of Basketmaker closed loop fabrics include a small apocynum bag six inches long from White Dog Cave, and fragments in human hair and vegetal fiber from Kinboko and Sayodneechee Canyons near Kayenta.[159]

Looped fabrics of fiber or human hair continued to be made in Pueblo III times, taking the form of leggings, shoe-sock uppers, bags, and caps.[160] At that time also some looped fabrics of cotton or cotton-and-wool were made in northern Arizona. With the coming of the Spaniards, the technique died out among the Puebloans, being replaced by knitting with needles and crocheting. Leggings and socks are the principle articles produced by these European techniques today, as might be expected, in view of prehistoric traditions.

Outside the Anasazi area, looping in fiber and hair was also important from pre-cotton horizons on. A complete record of its distribution in the Southwest should be charted on the basis of a study of museum collections. The literature mentions closed loop fragments from Ventana Cave, Tonto, Chavez Cave, Tularosa Cave, Cordova Cave, Shumla Cave, and Bee Cave.[161] There are closed loop fragments from McEuen Cave and Hidden House in the collections at the Arizona State Museum, and the technique is important in materials from the caves of Coahuila. The large *kiaha*, or carrying bags of the Pima and Papago were made by closed looping. References to its occurrence in prehistoric Peru may be found in O'Neale's publications.[162] For a more complete statement on the distribution of closed looping in the New World, archaeologically and historically, consult Davidson.[163]

2. Looping Over Foundation Cords

Two tiny lace-like fragments from Greenwood Cave (probably early Pueblo III) may be tentatively classified as a form of looping (or possibly plaiting) carried on over foundation cords, which were probably anchored at both ends so as to be stationary.[164] Both are cotton, described as "right-spun" (meaning S-spun), single-ply and about the size of #100 commercial cotton thread. The following analyses are taken from Cosgrove.[165]

One fragment (PM 95535a) is: "Made up of round 6-strand braids joined at regular intervals by an independent looped strand from opposite braids to make a net with a mesh less than 1/16 of an inch. The loops joining braids do not interlock."

The technique of the second fragment (PM 95535b) is shown in our figure 112, E. It is $\frac{3}{8}$ inch wide by $1\frac{1}{4}$ inches long, and contains six "warps" in its present width. These are two-ply, Z-twisted strings. Cosgrove says of this: "The filler between the warps consists of closely

upon itself and tie it so that first and last loop meet. Now add a second row of meshes by passing the thread through the lower edges of the first set. Looping may be continued until the bag is of the desired size. A separate string, or heavier cord, run through the final row of loops, will serve as a drawstring at the mouth of the bag. The bottom of the bag is closed by drawing the original loops tight together with the edge cord, and tying it on itself.

[158] Davidson, 1935: 117–134. Mason, 1904: 248.

[159] Guernsey and Kidder, 1921: 77. Kidder and Guernsey, 1919: 173. Wendorf, 1953*a*: 150–153.

[160] Kidder and Guernsey, 1919: 100 and 117.

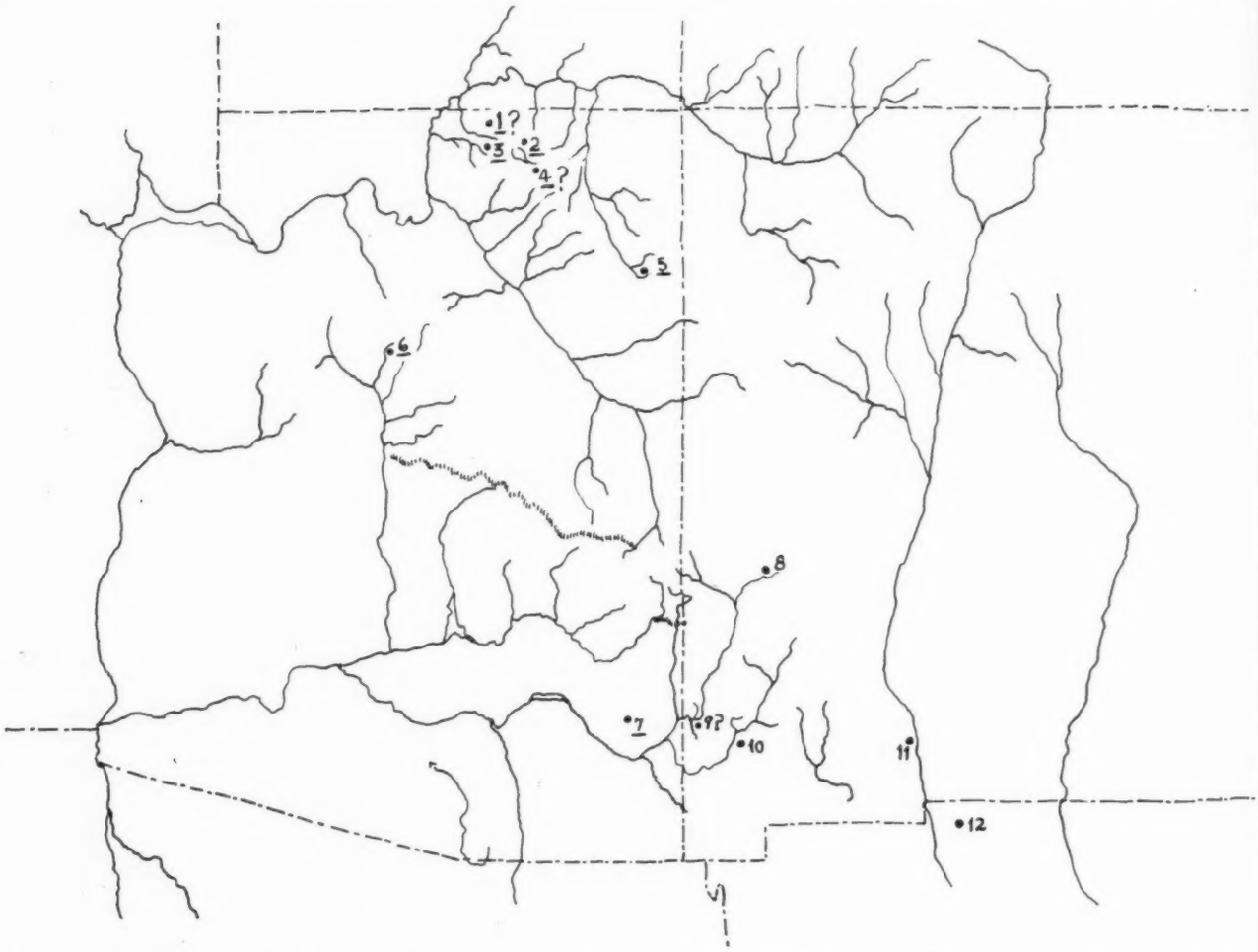
[161] Cosgrove, 1947: 71–72, 80. Haury *et al.*, 1950: 398–399. Martin *et al.*, 1952: 245. Mott, 1935: 3.

[162] O'Neale and Kroeber, 1930: pl. 26. O'Neale, 1937: 202.

[163] Davidson, 1935: 123–125.

[164] See Appendix, chart 11, *b*.

[165] Cosgrove, 1947: 76 and fig. 85.



MAP 11. The distribution of closed loop and netted cotton fabrics. (Sites yielding closed loop fabrics are underlined. Both closed loop and netting were found in McEuen Cave (number 7). Question marks after numbers 1 and 4 indicate doubtful proveniences. The question mark after number 9 shows that there is uncertainty as to whether cotton netting was found in Mule Creek Cave.) (1) Navaho National Monument. (2) Kiet Siel. (3) Gourd Cave and Two Mummy Ruin. (4) Kayenta area. (5) White House. (6) Hidden House. (7) McEuen Cave. (8) Tularosa Cave. (9) Mule Creek Cave. (10) Greenwood Cave. (11) Chavez Cave. (12) Cave 8, Hueco Mountains.

waved strands attached to the warps at their bends by a separate thread twined around each warp. Possibly some attempt may have been made to enrich the lace with a design, for 1 frayed edge shows the use of heavier looped strands."

These pieces do not resemble anything else in the collections. In duplicating the second "net," I first fastened the foundation cords (*b*) between two rods. Then I twisted finer threads (*a*) about each cord. Finally I looped threads (*c*) between the foundation cords by passing them beneath the wrappers with the aid of a needle.

There is a third bit of "looping on foundation cords" from Mule Creek Cave. This was used as the foundation core for a feather string ornament. The piece is included here although it is not absolutely clear from the text whether it is cotton. Concerning it Cosgrove says:

As a foundation for feathers, a piece of cordage shows that 2 soft white strings were looped at the center and the 4 strands then wrapped spirally around a stick, after which they were sewed together with yucca thread. The stick was then removed, leaving a cylinder, through the interstices on the side of which the quills of downy white feathers were thrust, filling the center solidly and thus being held in place.[166]

The piece has been duplicated by quite another method, which is illustrated in figure 96, D. Five threads are fastened at a single point and allowed to hang free, as in braiding or plaiting. Four function as foundation elements, or free-hanging "warps." The fifth is passed around the outside of these, wrapping once about each in turn. A hollow netted tube or cylinder is thus fashioned. The foundation strings are automatically pulled into a spiral position by the looping

[166]Cosgrove, 1947: 122–123.

process, and the "wrapper" slants gradually downward as it moves. The technique is simple and the cylinder grows rapidly. If this was the method of manufacture the piece should be considered a form of plaiting and classified under the term "wrapped plaiting."

3. *Netting*

Definition

Netting is a form of looping in which the thread is knotted to the mesh above it rather than simply looped through it.

Technical Description

There are nine examples of cotton netting. Five, from McEuen Cave, are of unknown date. A sixth piece from Tularosa Cave dates to the Georgetown Phase (500–700). A fragment from Cave 8 in the Hueco Mountains and two from Chavez Cave are doubtfully called "Pueblo."[167] Three types of knots were used in making the nets: the netting knot, six examples; the lark's head, one; and the overhand knot, two. The McEuen Cave nets were analysed while in the Gila Pueblo collections by Dorothea Kelly, whose notes and sketches furnish the basis of the descriptions given below. Experiments in duplicating the various nets led me to modify some of her findings, especially in the case of GP #116. I have had no opportunity to check my results against the original specimens.

Netting today is a universal art which varies but little in different parts of the world. The knot generally used has many names, among them "sheet bend," "thief's knot," "weaver's knot" and simply "netting knot." This knot, and the way in which it is tied, are illustrated in figure 98, E. A broad, flat stick, called the "mesh stick," serves as a gauge to keep the size of the meshes uniform. The netting string is wound on a small, narrow stick. In other parts of the world, where netting is more highly developed than in the Southwest, this stick resembles a bobbin and is called the "netting needle." The mesh stick is held at the bottom of a loop, the string passed around it and held against it firmly with one hand, while the netting needle is carried through and around the loop and the resultant knot pulled tight with the other hand.

This conventional procedure was used in making the three Hueco Mountain nets and three from McEuen Cave. One of the latter (GP #120) is an unfinished net about 30 inches long and 38 inches wide at its lower edge. A small stick wound with thread remains attached to the last row of meshes (figs. 98, E; 103). Loops at the upper edge are gathered together by a loosely-twisted four-ply cord, perhaps the one along which the first row of meshes was strung. Most of the net is composed of meshes one inch wide, worked in four shades of fine, brown thread about 1/32 inch in diameter. Each color was used for one row of meshes

[167] See Appendix C, chart 11, *c*.

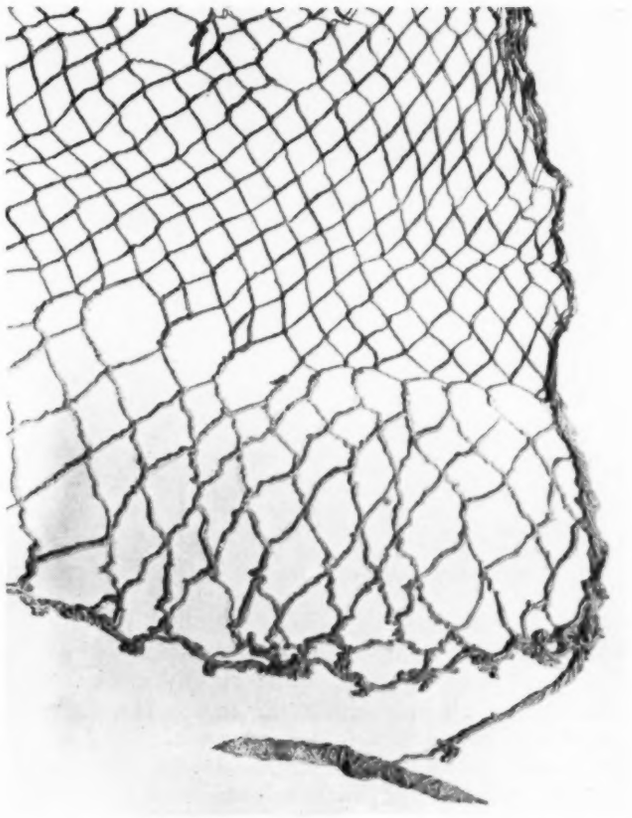


FIG. 103. Cotton net fashioned with a regulation netting knot and with netting needle and unused length of string still attached to its unfinished edge. McEuen Cave. (Gila Pueblo #120. Photo by E. B. Sayles.)

at a time, so that the net was horizontally banded. With each color change the yarn was broken and knotted carelessly. A shift was made to slightly coarser white yarn and a more open mesh near the lower edge of the net.

All netting knots were made with the yarn moving from right to left. This means that the net was turned over after a row of loops was finished, so that the thread would be at the worker's right as he commenced the next row. Viewed from one surface the knots in alternate rows thus vary slightly in appearance. Those marked *b* in our drawing of the net are netting knots as seen from the underside.

The netting knot was used in the manufacture of two other McEuen Cave nets (GP #119 and #118). The first is a net about 110 inches long by 25½ inches wide at the lower edge. Some of the knots appear to have been worked from left to right. In the upper part of this net, knots are grouped by units of sixteen into decorative diamonds, widely separated from one another by long stretches of unworked thread. These are actually extra large loops, about eight times the size of those within a diamond figure (fig. 98, F, 1–4).

The second (GP #118) is a large net, 79 by 98 inches in size, with meshes averaging about 6 by 9

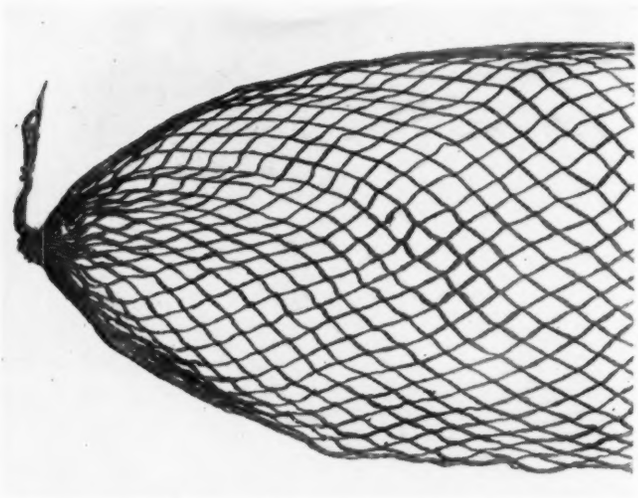


FIG. 104. Cotton net worked with overhand knot. Top to bottom edge, 11⅜". McEuen Cave. (Gila Pueblo #116. Photo by E. B. Sayles.)

inches. In reconstructing the piece I found it helpful to run the netting string between two solidly anchored edge cords (fig. 98, B). The six-ply cotton cord gathering and binding together the loops at one edge of the net may have served in such a capacity. The string was passed to the left in a series of very loose loops, being knotted to the mesh above every nine inches. At the left edge it was looped around the stationary cord and then twisted back on itself. It was carried to the right edge in this manner, with small untwisted loops of thread left immediately below the netting knots of the row above.

A simple overhand knot was used in making GP #116 and #117. (fig. 98, A, C) These were probably done in substantially the same manner, although they are not at all similar in appearance. The first measures 131½ by 11⅜ inches, and the second 95½ by 9 inches. The long dimension of both is the distance from side to side of the net, while the shorter measurement is from top to bottom edge, if our analysis is correct. We assume that these were done as netting, but that knots were tied only on every other passage of the thread. In the case of GP #117 (fig. 98, A) a series of loops (*a*) were probably made along a supporting cord or stick. Our drawing shows the thread passing from right to left for this step. From the left edge of the net the thread was drawn straight back to the right along the lower edges of the loops (*b*). On its next passage left it was handled as in regular netting, knotting over the loops and the straight length of thread above it. The netting throughout the piece is highly irregular, with knots made at uneven intervals, and meshes taking the form either of triangles or rectangles. Upon completion of the article, the netting thread was run through the loops at one edge and knotted, while a two-ply cord gathered loops at the other edge. Netting thread is loosely-spun single-ply white cotton.

GP #116 is made of two-ply cotton, with meshes about an inch wide, and knots evenly spaced, as though a gauge had been used. It can be done with a single thread, as shown in figure 98, C, 1, in a technique essentially the same as the one just described for GP #117. The same result can also be achieved by using a double thread, tying knots every row instead of every second row. This would result in differences in the edge loops, and a variation between alternate rows of knots, as shown in figure 98, C, 2. These factors have not been checked against the net itself. At one edge loops were gathered over fourteen two-ply strings, which were knotted, with their ends forming a tassel (fig. 104). At the other end the net was cut off and a cord made of five two-ply yarns run through the last series of loops and knotted, forming another tassel. The cotton net from Tularosa Cave measures about 20 by 4 inches. The ends are tied so that the net forms a circular band of fabric. The knot used is called a "lark's head" (fig. 98, D).

The Use, Distribution and History of Netting

There is considerable question as to the use made of cotton netting. The three large nets from McEuen Cave may have been snares for catching small game like rabbits, although the fine cotton yarn from which they are made seems singularly unsuited to such a purpose. For a good description of the use of rabbit nets, as practiced historically by the Paiutes, consult Guernsey and Kidder.[168] The long, narrow shape of two of the McEuen Cave nets, and that from Tularosa Cave, suggests they might have served as sashes. The Hueco Mountain fragments are thought to be either snares, fish nets, or bags.[169]

The manufacture of nets must have been one of the first things man undertook to do after he learned to make spun fiber and cordage. It became, as we have said, a universal art. In the Southwest, nets were made of fiber or human hair both before and after the acquisition of cotton. In fact, the infrequent appearance of cotton netting indicates the new fiber was not generally used in this manner. Fiber nets were employed as rabbit snares, small bags, and in one case (Ventana Cave) as the belting for a breech cloth.[170] The netting knot was generally used, although there is lark's head knotting at Ventana Cave, and an example of netting with the overhand knot from Tularosa Cave.

The only example of cotton netting which is well documented is that from Tularosa Cave, dated between 500 and 700. The Hueco area fragments come from caves yielding both Basketmaker and Pueblo remains, according to Cosgrove.[171] He calls the cotton finds "Pueblo"

[168] Guernsey and Kidder, 1921: 77–79.
[169] Cosgrove, 1947: 73.
[170] Martin *et al.*, 1952: 246. Haury *et al.*, 1950: 398–401.
[171] Cosgrove, 1947: 31–33, 39.

simply, I believe, because they *are* cotton, which he understood to be associated only with the later horizons. It is entirely possible that the fragments are contemporaneous with the Tularosa finds. The McEuen Cave nets *may* also date to that horizon.

PLAITED FABRICS

Introduction

Plaited textiles are composed of a set of yarns, usually fastened at a single point or along one plane with ends free-hanging, and intertwined downward. These yarns take the position of warps, but are held together by being interworked with each other, rather than by means of a distinct set of wefts. In some forms of plaiting the yarns may be held rigid between two supports while being intertwined (p. 602). The following discussion groups plaited fabrics under two headings, "braiding" and "twine-plaiting." (See also the description of "wrapped plaiting," pp. 590–591.)

1. *Braiding*

Definition

Braiding, as the term is used here, is a form of plaiting in which each yarn passes diagonally over and under its fellows from one side to the other, or around and around the piece in the case of square and round braids, or braiding on a core. Yarns do not regularly interlink with their neighbors, as in twine-plaiting.

Technical Description

In addition to seventy-four braid fragments (Appendix C, chart 12), there are the following braided articles: a nearly complete sling (AMNH 29.1/7994) and shirt (BM 03.250–1) from White House; a small bag from Grand Gulch (AMNH H/12260); a cradle band (PM A3188?) and apron band (ASM 25982) from unknown sites in northern Arizona; braided drawstrings on the Marsh Pass sacks (PM A1848–49–50) and a Gourd Cave shoe-sock (ASM 2768); a bit of braid attached to a tump line loop from Mesa Verde (USNM 254.849); corner braids on blankets from Lake Canyon, Hidden House, Painted Cave and Canyon Creek (Appendix C, chart 15); and braids on corner fragments of a rag-weft cloth from Tonto (NPS–T 9/33) and plain weave cloth from Cliff Ruin #7, Sapillo Creek (PM 96939).

Four basic techniques may be distinguished: flat braiding in two rhythms, square braiding, round braiding, and braiding around a central core. A single specimen may combine two of these techniques. There are three examples of flat three-strand and four-strand braids. (Appendix C, chart 12, nos. MNA 695/NA-2519.532 and Haury, 1934:83.)

Flat braiding.—Flat braiding in the form of narrow bands and ribbon-like ties was done by interlacing threads in an over-two, under-two or over-three, under-three rhythm, the former type being by far more common. Over half (forty-eight) of the seventy-four fragments listed in Appendix C, chart 12 show this rhythm. Included are all braids from northern sites, those from Ventana Cave, examples from Mule Creek Cave, and one, the corner braid of the rag-weft fragment (NPS–T 9/33), from Tonto. The bands are of two-ply white cotton, ranging in width from $\frac{3}{8}$ inch (ASM 513, Tsegi Canyon) to $5\frac{1}{8}$ inches (AMNH 29.1/7545, Canyon de Chelly), but averaging between one and two inches wide. None is complete in length, but there are examples of the start end of a braid, and several finished ends, so we have some idea of the procedure followed.

The method of commencing a thirty-three-strand braid from Gourd Cave (ASM 3024) is illustrated in figure 105, D (see also fig. 106). A string was probably passed around fourteen threads at the point marked *x*, tying them at their centers to a stake, or other support so as to furnish twenty-eight elements. Two more threads were then looped in a short distance above *x* so as to make four additional braid elements or thirty-two in all. These are numbered 15, 16, 17, and 18. They were interlaced with the original threads for a short distance to point *y*. Finally another thread, number 33, possibly one end of the tie-string, was added to the group to make the thirty-three elements of the braid. Actual braiding then began. The worker held in his left hand the threads numbered 1 through 16, lying with number 1 at the extreme left, and the rest in numerical order to 16, the innermost strand. In his right hand he held numbers 17 through 33, the latter being the outermost strand at the extreme right. The outer strand in the left hand (#1) was passed over-two, under-two threads to the right until it became the inner strand in the right hand. Then the outer strand in the right hand (#33) was passed over-two, under-two to the left to become the inner strand in the left hand. These two steps were repeated until the braid reached the desired length.

One way of finishing off a flat braid is illustrated in figure 105, E. (ASM 513, Tsegi Canyon). The sixteen threads composing the braid were separated a few inches from the end and worked into two eight-strand braids, one above the other. The eight strands of each of these were then further divided to make four-strand braids. A thread tied about the end of each of these kept it from ravelling out. The ends of the braiding yarns were made into a sort of tassel by separating the two plies of each yarn. Several other flat braids were finished off by separating strands into smaller groups and fashioning these into square braids.

Over-three, under-three braiding is illustrated in figure 105, A. There are eleven examples, one from Montezuma Castle, eight from Tonto, and two from Mule Creek Cave. The Montezuma piece is a forty-nine-strand braid in two-ply white cotton. Six of the eight Tonto braids are of finely-spun single-ply cotton,

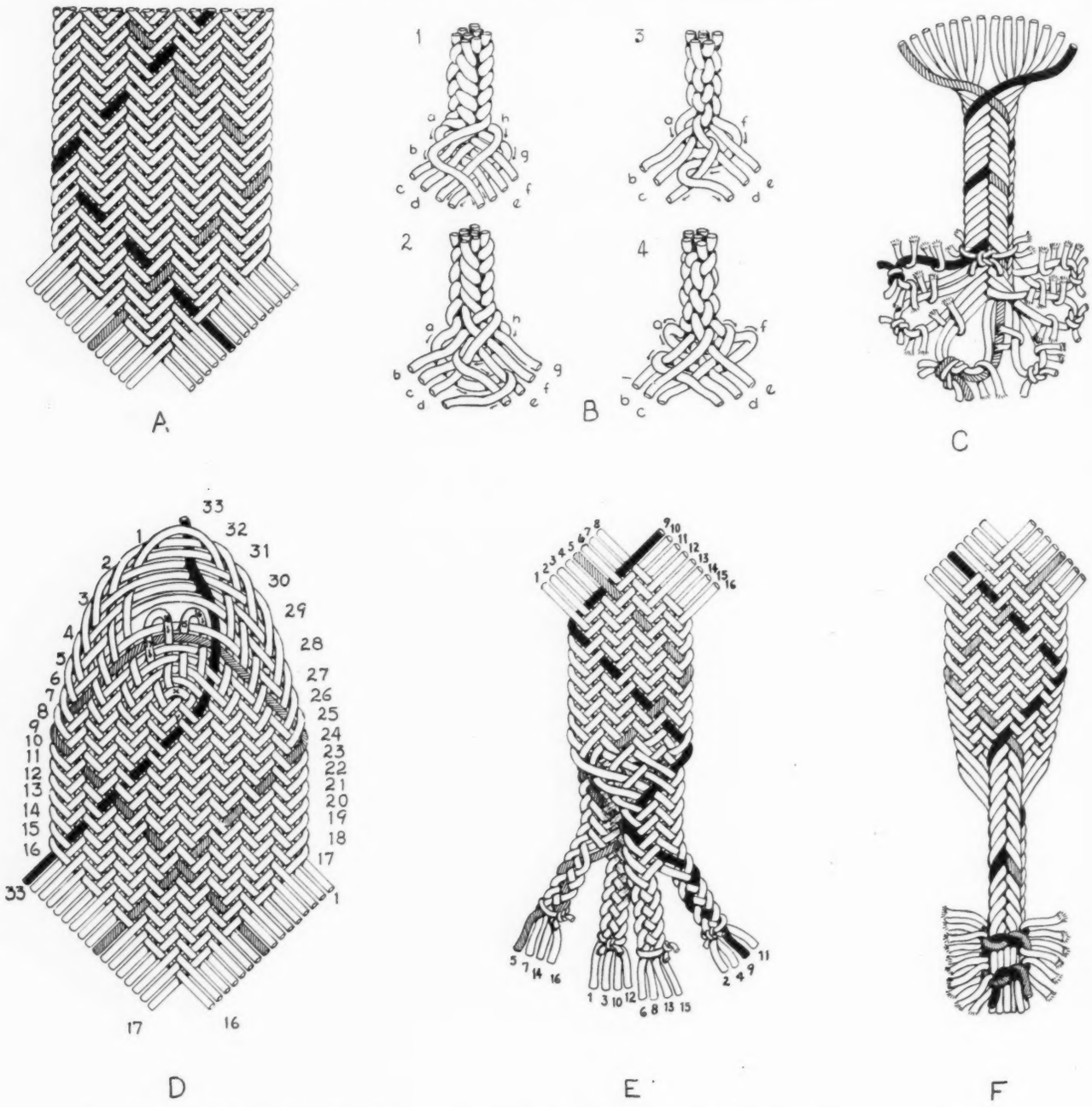


FIG. 105. Techniques of braiding flat, square and round. (The shading in this figure does not represent color, but is done so that the eye may follow certain key strands more easily.)

A. Over-three under-three flat braiding.
B. Braiding round and square. (1) Eight-strand square braid. (2) Eight-strand square sennit. (3) Six-strand half-round sennit. (4) Six-strand round sennit.
C. Construction of a pompom at the end of a square braid, done by looping short lengths of string beneath the tied ends of the braid strands. Gourd Cave. (ASM 2839.)
D. The construction of a 33-strand over-two under-two flat braid. Gourd Cave. (ASM 3024.)
E. Finishing the end of a flat braid in smaller units. Tsegi Canyon. (ASM 513.)
F. The end of a flat braid worked into a square braid and finished off with a pompom. Olla House. (PM A1557.)

while two are two-ply. All are white except for a brownish-black piece which appears to have been charred (NPS–T 9/215). Tonto braids are very narrow, ranging from 5/16 to 1⅛ inches. One of the Mule Creek braids is of single-ply red cotton, the other, two-ply white. Curiously enough, there are no over-three,

under-three braids from Anasazi territory, nor are there any in single-ply cotton.

Square and round braiding.—There are about twenty-five examples of square and round braiding—some appearing in isolated fragments, some in position as tassels at blanket corners, or fringing at the ends of flat braids, and some as tie cords for shoe-socks or small sacks. Most come from Pueblo III northern sites, but there are specimens from Sapillo Creek, Hidden House, Tonto Monument, and Bear Creek Cave. The technique, in other words, was widely distributed throughout the Southwest. All are made from two-ply white yarns, and most utilize but six or eight strands.

There are many different rhythms for braiding round or square.[172] Outlined below are two ways of braiding square with eight strands and two ways of braiding round and half-round with six strands.

Eight-strand square sennit (fig. 105, B, 2).—In this, as in the following methods, separate the strands into two equal groups. Hold each group flat with the strands always in the same relative positions. *Step 1*: start with strand *h* down under and around from right to left, then up between *b* and *c* and over *c* and *d* to the right, which will place it on the inside of *e*. *Step 2*: bring *a* down under and around from left to right and up between *e* and *f*, then over *e* and *h* to the left, which will place it on the inside of *d*. Repeat same movements with strand *g*, then strand *b*, and so on.[173]

Eight-strand square braid (fig. 105, B, 1).—*Step 1*: start with strand *h* down *over* to the left to the inside of *d*. *Step 2*: bring *a* down *under* to the right to the inside of *e*. *Step 3*: bring *g* down *under* to the left to the inside of *h*. *Step 4*: bring *b* down *over* to the right to the inside of *a*. Repeat these four steps, always bringing the outer strand of the right hand group to the inside of the left hand group, and *vice versa*, in the sequence: over, under, under, over.[174]

Six-strand half-round sennit (fig. 105, B, 3).—*Step 1*: begin with *a* down and under from left to right and up between *d* and *e*, over *d* to the left, to the inside of the left hand group. *Step 2*: bring strand *f* down and under from right to left and up between *c* and *a* and over *a* to the inside of the right hand group. Alternate these steps.[175]

Six-strand round sennit (fig. 105, B, 4).—*Step 1*: start with strand *a* down and around in back from left to right, then over *f*, under *e*, and over *d* to the left to the inside of *c*. *Step 2*: bring strand *f* down and around in back from right to left, then over *b*, under *c* and over *a* to the inside of *d*. Alternate these steps.[176]

The end of a square or round braid was finished by tying the strands off in pairs. Often a sort of pompom,

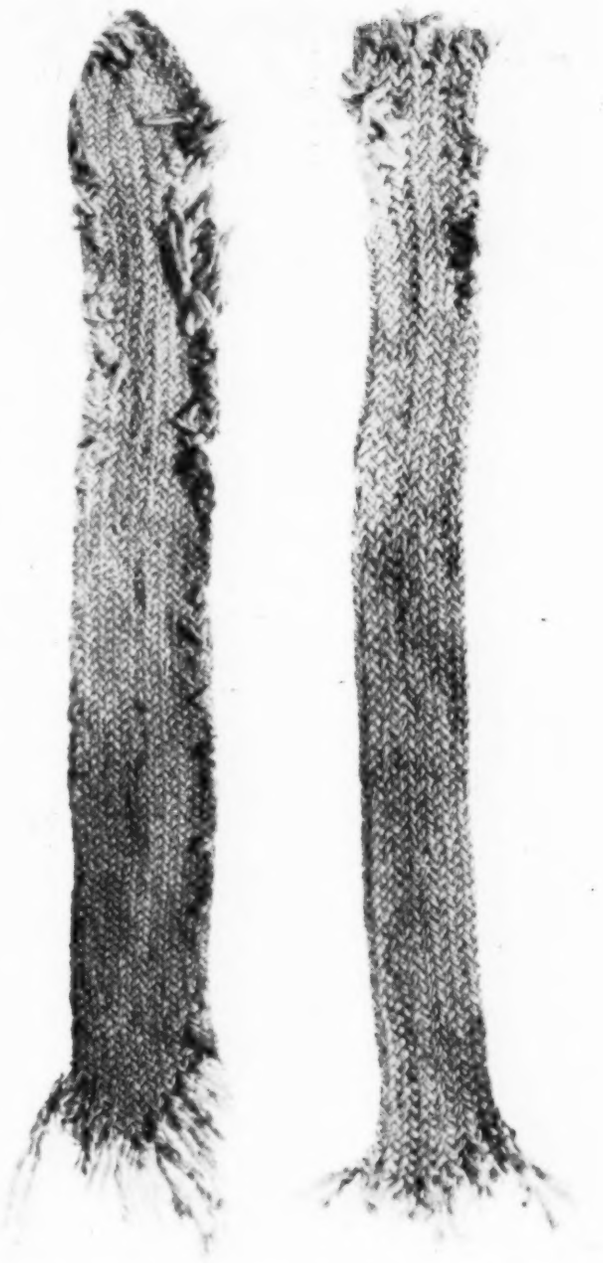


FIG. 106. White cotton braids, Gourd Cave. Braid at left, with start end complete, is 1¼" wide. (ASM 3024. Photo by E. B. Sayles.)

or soft white ball, was made by looping short lengths of soft-spun cotton thread between the tied strands (fig. 105, C; p. 579). A variation in the manner of fastening the looped threads is shown in figure 105, F. Here the core of the ball consists of all but two of the braid strands, which were cut off even across the bottom. The two uncut strands were wound and knotted about this core. The extra bits of string for the pompom were tucked beneath them. A similar method was followed

[172] See Graumont and Hensel, 1943: 224–228, pl. 112, 113 in particular.
[173] Graumont and Hensel, 1943: 226, fig. 6.
[174] Douglas, 1938*b*.
[175] Graumont and Hensel, 1943: 226, fig. 5.
[176] *Ibid.*, 226, fig. 10.

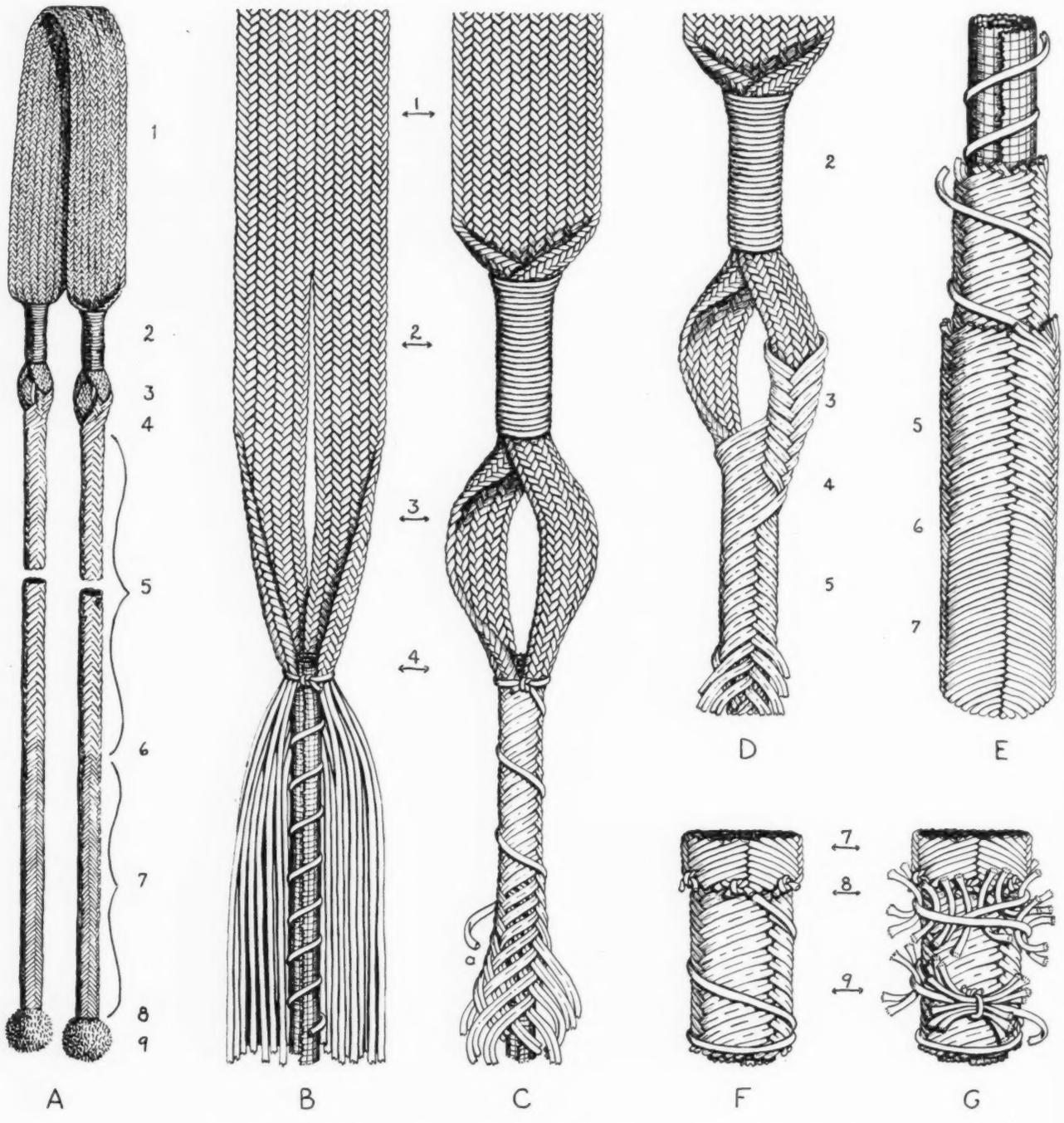


FIG. 107. Braided tump line or sling from White House. (AMNH 29.1/7994.)

A. A diagram of the sling as a whole, showing the flat-braided center, long rope-like ends made by braiding around a core, and heavy pompoms. Length, 102".
B. Detail showing the insertion of a rolled strip of plain weave cloth for the core of one of the ropes.
C. The first course of braiding, carried out around the core with the ends of the strands from the center braid, and bound with string.
D. The outer layer of braiding done with paired strings which are looped through the braid above the core.
E. Detail showing the three layers from which each rope was made: the plain weave core; the first layer of braiding bound with string; and the outer covering of braid, with paired strings separated (at point 6) and used singly.
F. The outer braid strands cut and tied above the rope end.
G. The construction of the pompom at the rope end by the insertion of short lengths of soft thread beneath a string wound around inner core and braid.

in making the pompoms at the ends of the braided sling described below.

Hough describes and illustrates an ornamental fringe found in a shrine in Bear Creek Cave, burnt away from the article it had once adorned.[177] The fringe consisted of eight-strand square braids over each of which was slipped a ring formed by winding cotton string on a core of fiber. The two loose ends of the wrapping string were bound to the braid with fiber, so that the ring would not slip up the braid. Strands of the braid were knotted into a ball at their ends after the ring was in place.

It is probable that the braids once formed the fringe of a flat-braided wedding sash (often called "rain sash") like those worn ceremonially by Hopi, Zuni, and some other Pueblo peoples today. Modern sashes are much coarser than the Bear Creek Cave specimen, and the decorative rings are made over a foundation of braided corn husks.[178]

Round and square braids at blanket corners were described on p. 579.

Braiding around a core.—There are two examples of braiding around a central core, the long ends of the tump line or sling from White House (AMNH 29.1/7994), and a small fragment of cord from Tonto Monument (NPS–T R16–15).

The Tonto braid has a diameter of 5/16 inch. Its length, incomplete, is about 15 inches. The core of the braid consists of nine loosely-twisted (S-twist) strings, each containing two plies, one white and one tannish brown. Over this core eight strands are braided. Four of the strands are paired—not twisted—single-ply threads, one brown and one white. The other four are untwisted, paired single-ply threads, all white. Four braid crosses are effected on one side of the core, then four on the reverse side, and so on (fig. 96, E). The finished product has a highly decorative quality and may have served as a necklace or ornamental tie.

The White House braid is a remarkable article in an excellent state of preservation. It has been called a tump line, but may, in fact, be a sling. It should be compared with the Peruvian slings described by O'Neale.[179]

The piece, 102 inches long, combines two types of braiding: flat and braiding around a core. Two-ply white cotton string is used throughout. The construction of the braid is shown in figure 107. The center section consists of a flat over-two under-two braid 1⅝ inches wide and about 17 inches long (A, 1). At both its ends the strands were separated and worked into two smaller flat braids (B, 2). These were wrapped tightly together for about 2 inches (A, C and D, 2) and then left separate (A–D, 3). Near the ends of these braids (A–D, 4) the construction of heavy, rope-like cords commenced. These cords are from ⅝ to ¾ inch in diameter. They are made by braiding around a thick core. The heart of the core is a rolled-up strip of plain weave cotton cloth, loosely bound with a string. It was tied between the two flat braid ends. Around this core two-ply threads were braided in pairs. These were probably the ends of the threads used in the flat-braid center section, as our drawing indicates. However, where it is possible to see them, they look softer than those of the center braid. This may be due to the fact that they were not pulled taut while braiding around the core.[180] The core was now bound again with a tightly twined two-ply string (C, *a*).

Now the final outer covering of braid was added. Nine paired strings were looped at their centers between the small flat braids where they lay separated just above the core (D, 3). This gave a total of eighteen paired strings, nine passing around the core in one direction and nine in the other. Each pair crosses over four strands, then under four (A, D, E, 5). There are four chevrons, or points, of braid in the circumference of the cord at any given point. About 9 inches above the pompoms at the ends of the ropes, the paired strands were separated (A and E, 6), making thirty-six single threads, or two groups of eighteen. These pass over eight threads and under eight (A and E, 7). Illustrated in *E* are the three layers in which the ropes were built up—the central core of rolled-up plain weave cloth bound by a string, the first course of braiding, also bound by a string, and the final outer covering of braid.

Just above the ends of the ropes the outer braid strands were cut and knotted to prevent ravelling (F, 8). At the rope ends plain weave core and inner braid strands were cut off square. Over these two inner layers pompoms were constructed (F and G, 9). Short lengths of soft thread were looped beneath a string bound around the braid end. Bundles of such threads were also tied to the binding string. The threads were forced close together and their ends cut off, as described for other pompoms. Thus, at the end of each rope, or cord, there is a soft, white ball about 1½ inches in diameter (A, 9).

Braided shirt.—The remarkable shirt from White House combines flat, round, and square braiding (BM 03.250–1; fig. 108). In its present condition it is about 30 inches long and 20 inches across the shoulders. Originally a long fringe of square braids with heavy tassels at their ends extended from the bottom of the shirt. This is not at present attached to the shirt at all, but it probably added about 15 inches to the over-all length, making it around 45 inches from shoulder to hem line. The shirt seems narrow, but may have fitted

[177] Hough, 1914: 76, fig. 159.

[178] Kent, 1940: 50–52. See also pp. 601–602 below.

[179] O'Neale, 1937: 201–202.

[180] Certain details of manufacture could not be determined, because of the necessity of examining the article without destroying it.

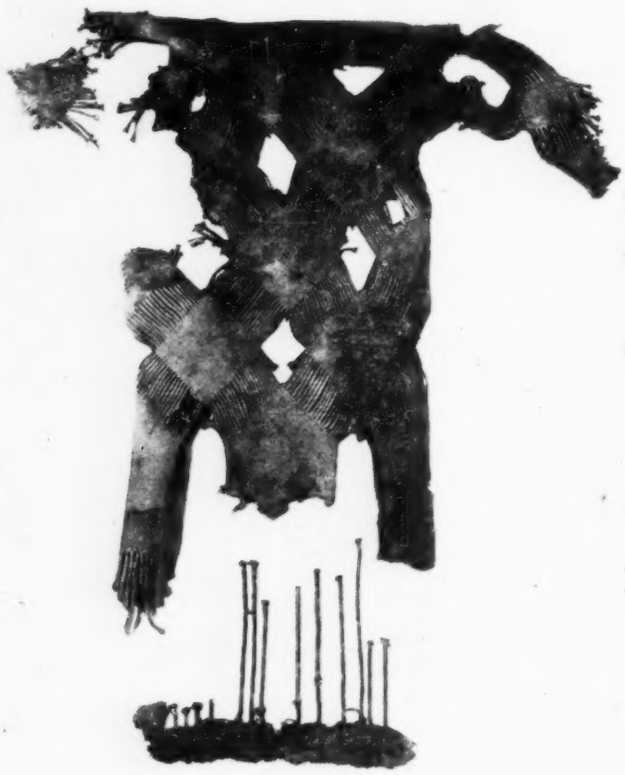


FIG. 108. White cotton string shirt, braided. White House. Length without fringe, 30″. (BM 03.250–1. Photo by Brooklyn Museum.)

a slightly-built adult, the length being taken up as width when the garment was put on.

Sturdy two-ply white cotton thread is used throughout. An over-two, under-two flat braid alternates with four-strand round braiding in the body of the shirt, while the heavy fringing consists of eight-strand square braids.

There are some details relative to the manufacture of the piece which I may not have analyzed correctly. The shirt is frayed at both arm holes where significant braid movements took place. However, the drawings (fig. 109) illustrate a process which may approximate that used. In B, 1 and 2, each of our strands equals eight in the piece itself.

Braid strands were suspended from a sturdy stick—possibly the top bar of an upright loom. I assume that the yoke was manufactured first, and that it was braided from one shoulder to the other. To do this, 480 strands were suspended from the bar (fig. 109, B, 1). Of these, the center 80 (4*f* and 4*b*) were fashioned into a flat braid (*A*) for a short distance. Then 40 strands (4*b*) from the right side of this braid were carried to the right into what would become the back of the yoke, while the remaining 40 (4*f*), carried left, became part of the front of the yoke. From this point to the second shoulder, front and back yokes, identical in manufacture, were braided separately. The ensuing remarks refer to the left hand, or front yoke.

The 40 strands (4*f*) were plaited through 80 (3*f*) to their left (*B*), until they hung free at the left of that group. Having completed this passage they were probably knotted loosely together and left hanging at the back of the yoke for the time being. (It seemed less complicated to show the strands cut off at such points in our drawing.) The 80 remaining threads continued to plait together for a short distance (*C*). Now 80 new strands (2*f*) were taken into the braid and, after plaiting with them (*D*), replaced the first group of 80, which was allowed to hang free at the left of the braid. The second group of 80 was plaited on itself for a short space (*E*), after which 40 additional threads (1*f*) were brought in from the left. These 40, carried through to the right, met a companion group of 40 (1*b*) from the back of the yoke, and were braided with them into an 80-strand braid (*G*) which was to become the second shoulder piece.

Now the work was unfastened from the bar, thrown over it and tied so that the front part of the yoke and strands hanging from it fell in front of the bar, while the back section and its strands fell behind it. (This is sketched in B, 2, which shows, however, only the front part of the yoke. The letters and numbers in this drawing match those in B, 1.) The underarm portions must next have been braided (B, 2). There are question-marks at these points, since the explanation here given is theoretical. The upper 40 strands at the outer edges of points *B* and *F* (1) may have turned in on themselves and braided through the lower 40 (2) so as to bring the total number of strands at the inner edges of points *B* and *F* to the 80 required in braiding the body of the shirt. This left 40 strands (2, ½ of 2*f* and ½ of 3*f*) at the outer edges of those points. These strands were to be taken into the sleeves Threads to be used for the sleeves may have been knotted up over the pole to keep them out of the way while the body of the shirt was braided.

Four groups of 80 strands—320 in all—now hung from the front yoke points, and an identical number hung from the back yoke points. These 640 strands were fashioned into a seamless cylinder—the body of the shirt. Figure 109, A, 1 is a diagram intended to show the braid movements followed. Each of the four groups of 80 strands depending from the front of the yoke is numbered—1, 2, 3, 4. Identical groups at the back of the yoke are numbered 1*b*, 2*b*, 3*b*, 4*b*. Numbers in parentheses give the position of groups at the back of the shirt, not seen in the diagram. After a course of braiding was completed on the front of the shirt, the worker had to repeat the identical steps on the back.

First each group of 80 was fashioned into 20 four-strand roundish braids of equal length. Next the strands were separated and those from groups 1 and 2 were combined into a 160-strand flat diamond-shaped

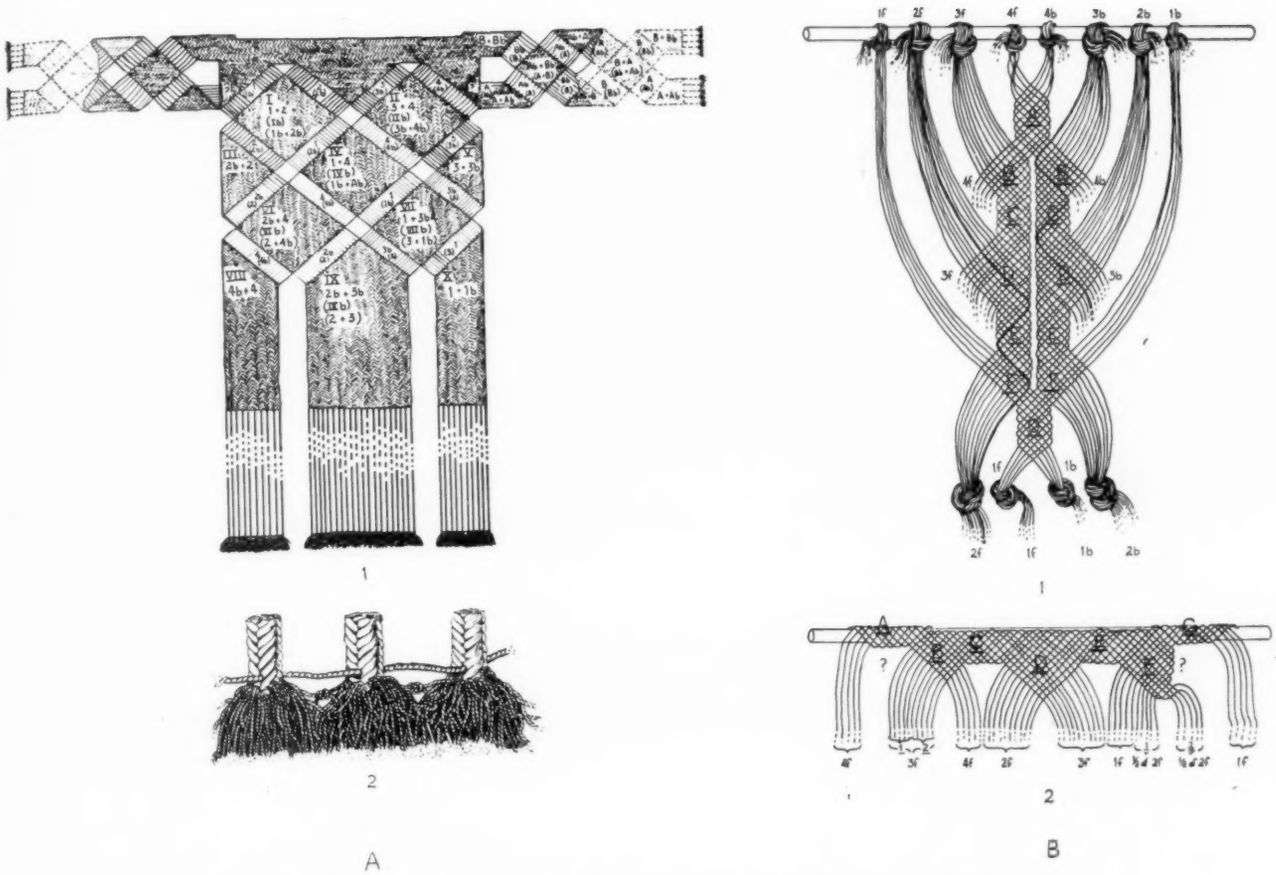


FIG. 109. The construction of the braided shirt from White House. (BM 03.250–1.)

A. Shirt and fringe. (1) A drawing illustrating the manner in which groups of strings entered into the braiding of the front of the shirt. An explanation of the letter and number symbols used on this and the other drawings in this figure will be found on pages 598–600 of the text. (2) Detail of the fringe composed of square braids and heavy tassels.

B. Theoretical reconstruction of the method used in commencing the braiding of the shirt. (1) Groups of threads fastened along a bar and intertwined for the yolk. (Each strand shown in this and B, 2 represents eight in the piece itself.) (2) The finished yolk hung over the bar in position for the braiding of the body and sleeves of the shirt.

braid (I), while groups 3 and 4 were similarly combined (II). At the back of the shirt groups 1*b* and 2*b* and groups 3*b* and 4*b* were fashioned into identical flat diamonds (I, *b* and II, *b*). At the lower edges of the diamonds, more four-strand round braids were made. Next the strands were again separated and re-combined into flat diamonds. This time group 2 from the front and group 2*b* from the back formed a diamond (III) at one side of the shirt. Groups 1 and 4 made up the center front diamond (IV), and groups 1*b* and 4*b* the center back (IV, *b*). Group 3 from the front combined with group 3 from the back to make the fourth flat diamond (V) at the other side of the shirt. After fashioning the small round braids, two more flat diamonds were plaited on the shirt front, and two on the back: VI and VII, (VI, *b*) and (VII, *b*). Then more round braids were plaited, and finally four flat braids, carried out into long panels with straight bottom edges: VIII, IX, (IX, *b*), and X. As the diagram shows, the two center groups from the top back of the yoke (2*b*) and (3*b*), have passed completely around the sides of the shirt to combine into the front center panel, IX, while the top center groups of the yoke front, 2 and 3, have moved to the back of the shirt to form the lower rear center panel (IX, *b*). Finally the strands were grouped into a series of eight-strand square braids, 20 depending from the lower edge of each flat-braided panel.

A portion of fringe, found with the shirt but not actually attached to it at any point, probably represents the way in which the article was finished off at the lower edge. At the end of each square braid a heavy tassel, $1\frac{3}{4}$ inches long was made by tying extra cotton strings to the braid strands. All these tassels were fastened together into a fringe, by means of a thread run through the braids just above them, and by tying certain strands from adjoining tassels together (A, 2).

The sleeves may have been braided last, the shirt being removed from the pole and fastened so that the strands for one sleeve hung free, then reversed in position for the second sleeve. Each sleeve is composed of

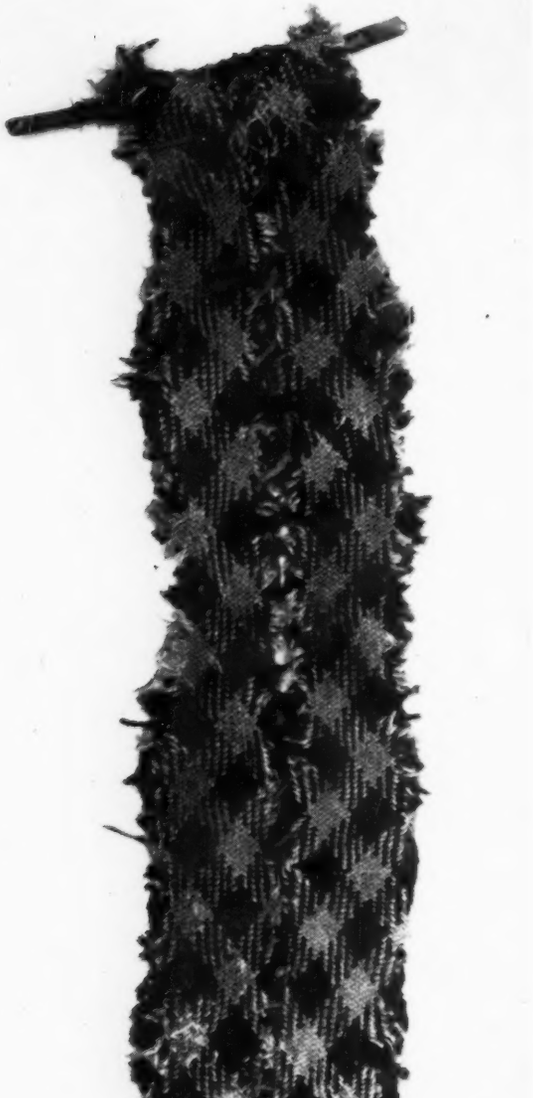


FIG. 110. Braided wool band sewed with cotton thread. Painted Cave. Length, 17". (Photo by Amerind Foundation.)

160 strands, 80 from the original shoulder braids (B, 1, *A* and *G*), 40 from the lower outside edge of the front yoke (B, 2, *2*), and 40 from the lower outside edge of the back yoke. These strands were braided as for the body of the shirt, except that each flat braid in the sleeve contains 80 strands instead of 160, and the diamonds are separated by sets of 10 four-strand round braids, instead of 20. The sleeves may have ended in eight-strand square braids and fringes to match the shirt bottom. A second shirt, also in a finger technique, twine-plaiting, is described on pp. 603–605.

The Uses of Braids

Flat braids between 1 and 2 inches in width apparently served as belts, hair ties, and garters. A flat band $3\frac{1}{4}$ inches wide and $13\frac{3}{4}$ inches long (incomplete), sewed between two small sticks, was probably used as a cradle band. The elaborate shirt from White House combines flat, square and round braiding. A small bag found at Grand Gulch, incomplete in length and 1 inch wide, was made by folding and sewing a 2-inch-wide flat braid.

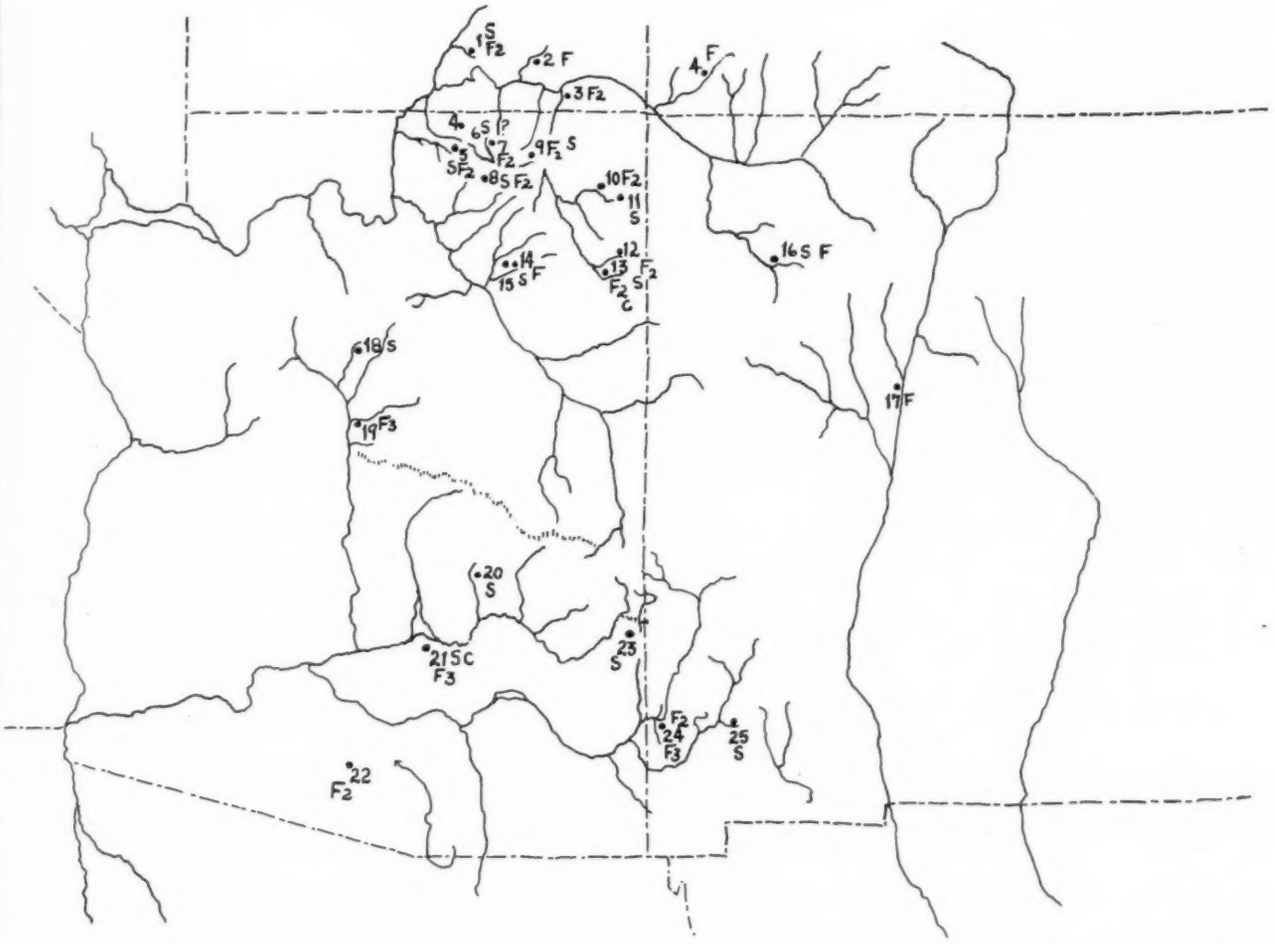
Square and round braids generally appear as tassels at blanket corners, or as fringing at the ends of flat braids. The drawstrings of the tiny cylindrical sacks from Marsh Pass (pp. 583–586) are round braids, as is the tie on a shoe-sock from Gourd Cave. Braiding around a core was employed in the production of decortive cordage (Tonto) and heavy rope (as in the White House "sling").

The Distribution and History of Braiding

There are, all told, over eighty prehistoric examples of braiding in cotton from twenty-five known and several unknown sites. With the exception of a three-strand braid from Kiet Siel (MNA 695/NA2519.532), all Anasazi flat braids are over-two under-two in rhythm. All but one are made from two-ply white cotton. (There is a braid from Gourd Cave, ASM 2835, in which speckled brown fibers, possibly natural brown cotton, appear.) Flat braids from Ventana Cave resemble the northern examples in technique and material. Sinagua, Salado, and Eastern Mogollon flat braids present more variety. With few exceptions, all are over-three under-three in rhythm. Some are made from single-ply, others from two-ply threads. One, from Mule Creek Cave, is dyed red. An unspecified number of braids from this Cave, and one from Tonto, are over-two under-two in rhythm. Two flat, four-strand braids were found at Canyon Creek. Square and round braids are distributed pretty generally all over the Southwest.

Braiding is certainly a technique which antedated the loom all over the world. From Basketmaker sites in the Southwest come examples of braided yucca leaves and bast and wool threads. There are four handsome sashes of brown and white dog hair from Obelisk Cave,[181] and a fifth from neighboring Broken Flute Cave. These date to about 300, or Basketmaker II.

[181] Amsden, 1949: 3, pl. 3.



MAP 12. The distribution of cotton braids. (Letters accompanying the site numbers designate the following techniques: *C.* Braiding around a core. *F.* Flat braid, rhythm unknown. *F2.* Flat braid, over-2 under-2 rhythm. *F3.* Flat braid, over-3 under-3 rhythm. *S.* Square and/or round braids. The question mark by number 6 indicates doubtful proveniences.) (1) Lake Canyon. (2) Grand Gulch. (3) Poncho House. (4) Mesa Verde. (5) Gourd Cave. (6) Tsegi Canyon, Northern Arizona and Navaho National Monument. (7) Kiet Siel. (8) Sunflower Cave. (9) Olla House. (10) Hospitibito Canyon. (11) Painted Cave. (12) Mummy Cave. (13) White House. (14) Kawaika-a. (15) Awatovi. (16) Pueblo Bonito and Chetro Ketl. (17) Kuaua. (18) Hidden House. (19) Montezuma Castle. (20) Canyon Creek. (21) Tonto. (22) Ventana Cave. (23) Bear Creek Cave. (24) Mule Creek Cave. (25) Cliff Ruin #7, Sapillo Creek.

The sashes are flat braids coming to a point at each end. Here strands are separated into smaller groups and braided square so as to make long, rope-like fringing. A similar dog hair sash was found on a mummy from Tularosa Cave.[182] There are straight edges at the ends of this piece, from each of which hangs a fringe of three square braids. The sash cannot be dated. Also of uncertain period is a brown and white checkered braid of unidentified wool from Painted Cave, sewed (with cotton thread) into the form of a cradle band (fig. 110). It may be a Basketmaker piece re-utilized by Pueblo peoples.[183] Three fragments of eight-strand, round-braided cordage of black and white wool (unidentified) were found in Pueblo III sites in the Tsegi by Kidder and Guernsey,[184] indicating that the use of animal hair thread persisted to a degree until 1300. However, after the introduction of cotton that fiber became the material most commonly used for braided sashes, ties and certain other articles.

Braiding continued through Pueblo IV, at least for the making of ceremonial sashes. Jeddito murals illustrate narrow white belts as well as broad, white, fringed sashes.[185] The latter represent, without doubt, the "rain sashes" or "wedding sashes" of the type included nowadays as part of the Pueblo bride's trousseau, and worn thereafter by certain kachina dancers. Modern rain sashes are 4 to 8 inches wide and 8 to 10 feet long, including the fringe. Smith (*op. cit.,* 283) suggests

[182] Hough, 1914: 72–76.
[183] Haury, 1945*b*: 34–37, pl. 14, *a*.
[184] Kidder and Guernsey, 1919: 114.
[185] Smith, 1952*b*: 282–283, fig. 26, pl. F, I. See also our fig. 142, G.

that this type of sash may have been introduced into the Rio Grande Valley since Pueblo IV, as the broad, white belts depicted in Kuaua murals do not have the same sort of fringe. Sometime between Pueblo III and the present, braided ties and bands (aside from the wedding sash) went out of fashion for everyday wear, to be replaced by warp-float belting (see pp. 531–535).

The elaborate rain sash seems to represent a carry-over of ancient traditions expressed first in the dog hair sashes of Basketmaker II, but it presents some interesting differences from braiding done before 1300. (These differences appear first in the Pueblo IV Jeddito murals, as we have said.) The most obvious discrepancy is its width, which is three or four times greater than that of the early braids. It has been suggested that the white blanket and belt of the modern Pueblo bride may represent the everyday costume of the prehistoric Pueblo woman, and that the belt may have attained to its present exaggerated length, width, and weight as it became a ceremonial symbol rather than a practical article of dress.[186] It should be noted that plain and (probably) twill weave sashes, fully as wide and as long as the rain sashes, come from Pueblo III sites. These are probably the prototype of present-day plain weave sashes with brocaded ends.

A second difference between classic Anasazi and more recent braided sashes lies in the fringing. Pueblo III belt fringes generally consist of square or round braids, often with a soft cotton ball, or pompom at their ends. Contemporary wedding sashes and those in the Jeddito murals are finished in a series of narrow braids an inch or so long, from which hang great lengths of braid strands which are twisted together, instead of being braided round or square. A ring of braided corn husk bound with cotton thread is tied at the point where a narrow braid gives way to twisted strands. Similar rings, appended to square fringe braids, and found by Hough in Bear Creek Cave, probably date to early Pueblo III (see p. 597). I am confident that, in view of the great number of braids and fringes found in northern sites, at least one or two such rings would have survived if they had been a part of Anasazi tradition in Pueblo III. (Their lack in the smaller Hohokam, Sinagua, and Salado collections is remarkable, but not so conclusive.) They do occur, unmistakably, in the Pueblo IV Jeddito murals. The inference is that they represent a southern influence on Anasazi textiles just after 1300.

A final point of interest lies in the comparison of prehistoric and modern braiding techniques. At the present time strands are wound, tubular fashion, between two poles. These may be held in place by sandstone "warping blocks." Braiding is effected with the fingers, each course being held in with a short stick. The braid "grows" in two directions at once, in a manner similar to that described for warp-twine (p. 581). This process has been explained in another publication.[187] It is used also by Indians of the Guianas, in the southwestern Amazon Basin and the Lake Titicaca Region. In Mexico it is reported for the Otomi.[188] O'Neale's report on Peruvian Necropolis braids suggests that strands were anchored at both ends, but not that they were wound between rods tubular fashion.[189] There is no proof that frame-braiding was practiced prehistorically in the Southwest before Pueblo IV. Diagnostic features would be straight edges at the ends of the braid, and a sort of ridge at its center, marking the point from which the braid was built in both directions. If center and ends are missing, there is nothing to distinguish a finger-braided from a frame-braided band. Even if both these features should appear, there would be no proof that the strands had been strung tubular fashion. Both the straight edge and a center ridge may be achieved by finger-braiding, if desired. Pueblo III and earlier braids generally end in a *V* which means they definitely were not frame-braided. However, there are a few straight-edged examples which could have been made either way. The one start end of a Pueblo III cotton braid that we have does not indicate use of a frame.

The presence of a great number of strands is in itself no proof of frame-braiding, although having the strands of a very wide braid anchored at both ends may make it easier to keep track of them. The extremely complex finger-braided sashes of the Great Lakes region, employing two and three hundred strands, are accomplished with free-hanging threads. Certainly the narrow Pueblo III braids could have been done easily with no tools. The wide, straight-edged, fringed sashes in the Jeddito murals may have been done by frame-braiding, as are their modern counterparts.

In short, we cannot prove frame-braiding was *not* done prehistorically, but evidence favors finger-braiding as the more likely technique through Pueblo III. Frame-braiding may be a recent introduction from Mexico, which reached the Hopi country in Pueblo IV and later spread to the Rio Grande. There is also the possibility that this technique was an Eastern Mogollon specialty associated with "warping blocks" and introduced with them into northern Arizona in Pueblo IV (pp. 487–488). Small cotton-bound rings on braid fringes may have been part of the same complex.

Summarizing our present knowledge of braiding in the Southwest we can say that some form of this technique has been practiced from about A.D. 200 until the

[186] Kent, 1940: 46. In this article the shift from narrow to wide braids is stated to occur after 1600, when the women began to wear woolen dresses and belts, due to Spanish influence, and discarded the white cotton blanket and sash except for ceremonial use. The Awatovi murals and other evidence has since convinced me that the real changes occurred before Spanish intervention, or in Pueblo IV.

[187] Kent, 1940: 46–52.

[188] This information was furnished by Miss Elsie McDougall of Woodstock, New York.

[189] O'Neale, 1942: 162.

present. Four basic methods were used prior to 1300: braiding flat, round, square, or around a core. The articles made included mainly narrow bands needed for dress, such as sashes and various kinds of ties. Other articles, such as shirts, slings, and cradle bands might also be braided. Yucca fiber, yucca leaves, and wool were braided in Basketmaker times, but by Pueblo III most braiding was done in cotton. Some time between 1300 and the present, braided ties and sashes for everyday wear were replaced by warp-float belting. The Jeddito murals indicate this change began in Pueblo IV, at which time the wide, heavily fringed rain sash, possibly braided on a frame, first appeared. This is the only form of braiding currently practiced by the Pueblo Indians.

2. *Twine-plaiting*

Definition

In twine-plaiting all threads are fastened along a single plane and twisted together from the top downward. Adjoining threads make one or more twists about each other, separate to become units of new pairs, and then return to their original positions.

Technical Description

Twine-plaiting is represented by only three specimens—a shirt and a small fragment from Tonto, and a narrow band, 11 × 1 inches, from Mule Creek Cave. All are of two-ply white cotton.[190]

As O'Neale has pointed out, twine-plaiting and gauze weave look much alike, but there is: "The very important technical difference that twined yarns twist completely about each other by contrast with gauze weave yarns, which merely cross each other from right to left and back again." [191] In gauze weave, warp crosses are held in place by the weft. In twine-plaiting there are, of course, no wefts. Since the strands are free-hanging they may twist completely about each other. Holes are made as plaiting proceeds by the simple device of neglecting to complete the regular twist of two threads. Such holes, grouped into triangular points, diamonds or oblique lines, form openwork patterns against the close mesh of the background (figs. 99, B; 112, D).

The technique is simple enough in principle, but the worker must have his design well in mind before he commences to plait. The process, as carried out with ten threads in the laboratory, is as follows:

Number the threads from 1 to 10, starting at the left. They should lie flat, side by side, between thumb and forefinger of the right hand. The manipulation of threads is done with thumbs and forefingers of both hands.

Step 1: Pass #1 to the right, over and back under #2, so that it resumes its normal position to the left of #2. Hold #1 over forefinger of left hand, drop #2.

[190] See Appendix C, chart 13.

[191] O'Neale, 1942: 162.

FIG. 111. Twine-plaited shirt from Tonto Monument. Length 26″. (ASM 13400. Photo by E. B. Sayles.)

In the same manner pass #3 around #4, #5 around #6, #7 around #8, and #9 around #10. You will now be holding #1, 3, 5, 7, and 9, lying in that order from left to right along your left forefinger.

Step 2: Retain #1 in your left hand. Transfer #3 through 9 to the right forefinger.

Step 3: Pick up #2, pass it to the right over and around #3 until it resumes its normal position at the left of #3. Hold #2 in the left hand and drop #3. In the same manner pass #4 around #5; #6 around #7; #8 around #9; and pick up #10. You will now be holding #1, 2, 4, 6, 8, and 10 lying in that order from left to right along your left forefinger.

Step 4: Transfer these threads to the right forefinger. Repeat from *Step 1*.

Twine-plaited shirt.—In making a wide article like the Tonto shirt (fig. 111), the plaiting may have been done in sections, the worker manipulating only a portion of the strands at a time. The shirt is badly stretched, but measures about 26 inches from shoulder to fringe, and nearly the same across the bottom.[192] Figure 112, B shows how the strands may have been fastened for plaiting the shirt. A two-ply thread runs across each shoulder. Four-ply threads, passing around the neckline, were knotted to these shoulder cords. The strings to be plaited for front and back of the shirt were looped closely together along both shoulder cords and around the neckline (fig. 112, A). The shoulder and neck cords were probably lashed tightly to a long stick set across two poles, or the upper loom beam. In plait-

[192] The shirt was found rolled up and tucked under the head of an infant buried in the upper cliff ruin. The child had been wrapped in cotton cloth, and placed between two halves of a twilled yucca basket. On the body was the fringed skirt described on p. 616.

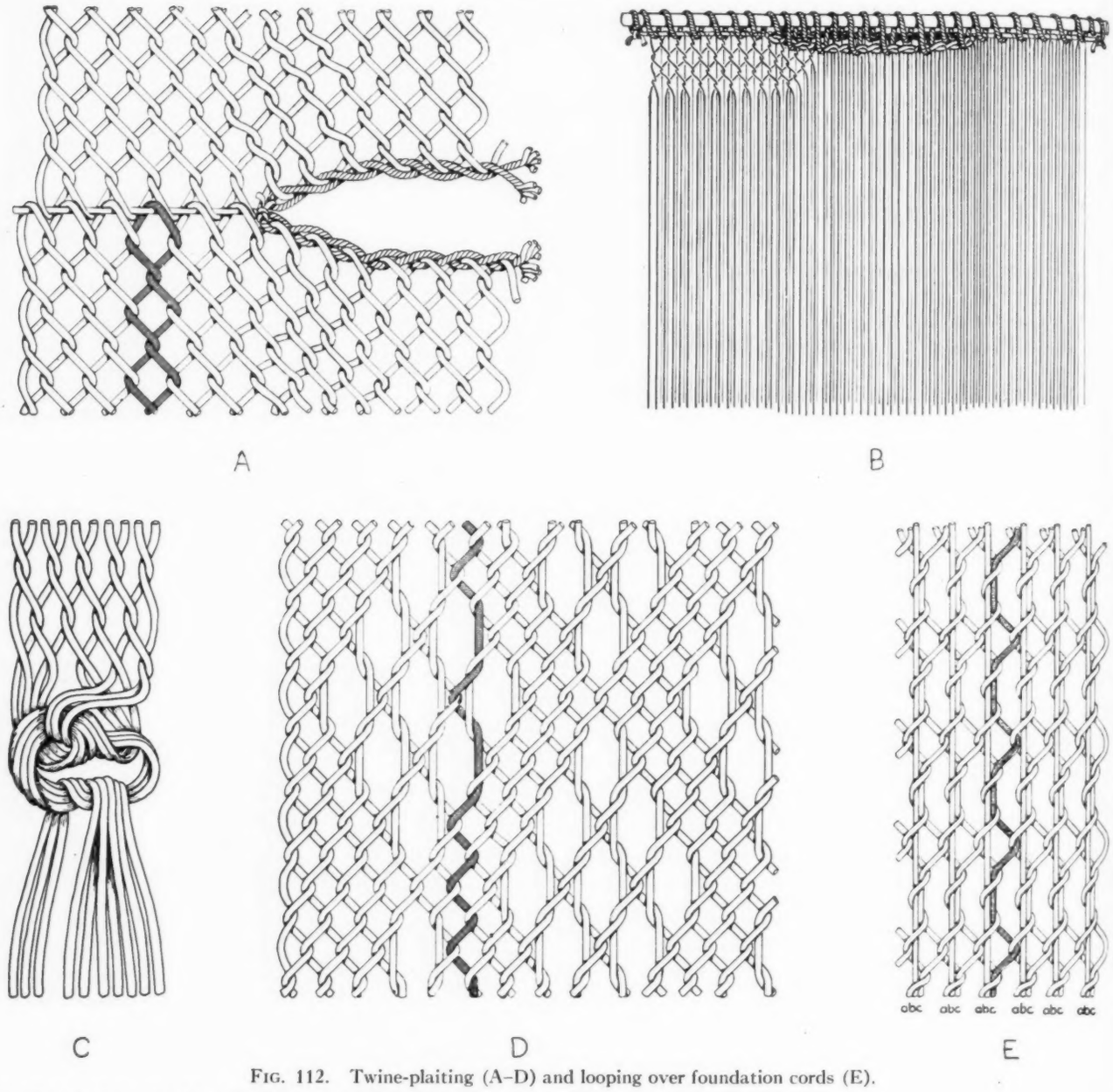


FIG. 112. Twine-plaiting (A–D) and looping over foundation cords (E).

A. Detail of the shoulder and neck of the twine-plaited shirt from Tonto. (ASM 13400.)
B. Reconstruction of the manner in which threads may have been fastened along a rod in preparation for the manufacture of the twine-plaited shirt.
C. The knotting of threads in the fringe at the lower edge of the shirt.
D. Detail showing how a pattern of holes was made in twine-plaiting.
E. Looping over a foundation of six strings. Greenwood Cave. (PM 95535b.) (Foundation strings may have been placed horizontally rather than vertically as shown here.)

ing the front of the shirt, every other looped string along the shoulder cords and all the strings along the front of the neck were intertwined. The remainder were reserved for the back of the garment.

It is impossible to say, of course how so many threads were managed from this point on. Perhaps a narrow panel of fabric was plaited at one edge of the shirt. After a few inches of this the threads were tied or knotted temporarily to keep them from "untwisting," while an adjoining panel was completed. In this way a narrow length of fabric would be plaited from shoulder to shoulder and added to gradually from top to bottom. Or it may be that the worker completed a panel of plaiting from shoulder to fringe, and then added a second, a third, and so on, until the shirt was finished. Since the threads are not fastened at the bottom, it would be easy enough to pass the edge thread of a new panel through the loops of the already-plaited portion

in proper sequence. No evidence of these joinings would show in the completed fabric.

The fringe at the shirt bottom was made by separating the threads into groups of ten, plaiting these together for an inch or so, and then tying them in a crude knot (fig. 112, C). Front and back (now largely missing) were separately plaited and then sewed together from underarm to hem with an overcast stitch.

The Distribution and History of Twine-plaiting

Since twine-plaiting, like braiding, requires no knowledge of loom processes, we might expect it to show up in pre-cotton horizons. However, to my knowledge no twine-plaited fiber material has been reported from Southwestern sites. We have only the three cotton pieces just described. The Tonto examples date to Pueblo IV and the Mule Creek Cave piece is probably early Pueblo III. Perhaps the occurrence of twine-plaiting so far south and relatively late in time marks it as a technique acquired by the southern people from the west coast of Mexico along with weft-wrap and gauze, and used by them to create the lace-like fabrics patterned in openwork designs rather than in color, which are more characteristic of southern than of northern textiles. Twine-plaiting, on the other hand, may be a very early pre-loom Mogollon technique persisting to some degree among the peoples of eastern Arizona and southwestern New Mexico. The suggestion is made on page 646 that in the latter area loom weaving was never important and many pre-loom finger-weave techniques were used in the manufacture of cotton fabrics.

Twine-plaiting is not plentiful in Peruvian collections. Two elaborately-patterned headdresses from Paracas Caverns were woven in this technique. These come from an early period in Peruvian weaving. There is no information on twine-plaiting in the regions between Peru and the Southwest.

WRAPPED CORDS

Cordage in general consists of multiple-ply thread, or several such threads twisted together. A cord made by braiding around a core was described above (p. 597). Only two examples remain to be discussed here. The first of these is a fragment from Kiet Siel (MNA 695/NA2519.287). It consists of a two-ply S-twined string which was held taut, then looped back on itself at one end and wrapped, together with a second string of the same nature about itself (fig. 96, B). Originally the loop at the top of the cord probably clasped some object which held the twist in at that point.

The second cord, from Montezuma Castle (NPS–MC 47), has a decorative quality marking it as the remains of a necklace or ornamental tie of some sort. It is 53 inches long in its present incomplete condition. The piece consists really of two separately made cords bound together at the center and near each end with wrapping of white thread. Each cord is made of six black threads which are wrapped at intervals of an inch or more with white threads. A white wrapper makes fifteen to eighteen turns about the foundation strings, completely concealing them (fig. 96, C).

VI. THE USES OF COTTON FIBER, STRING, AND CLOTH

INTRODUCTION

Most of the cotton material we have been describing consists of small fragments torn from larger cloths. However, there are enough remaining complete or nearly complete pieces to give a fairly good picture of the multiple uses made of cotton cloth. Fiber and string were also utilized in several ways. This information is grouped for description under two headings: *clothing* and *other uses*. It is summarized graphically in figures 113, 114, and 123.

CLOTHING

Cotton thread was employed first and formost in the manufacture of various articles of clothing, including: blankets, ponchos, shirts, kilts, skirts, aprons, breech cloths, socks, sandal soles, narrow ties, sashes, belts, and even a turban (figs. 113, 114).

1. BLANKETS

The word "blanket" has been used throughout the text as a general term for large, rectangular cloths sometimes referred to in other publications as "mantas." Some were, perhaps, dresses, worn as by modern Pueblo women, folded about the body, with the fold beneath the left arm, the edges meeting on the right side, and the blanket held in place by a belt around the waist, and by fastening the upper corners over the right shoulder. Others were probably shoulder blankets for men, women, and children. Blankets also served as burial shrouds. Usually these were worn, darned, and patched, indicating they had seen much use before the individual's death. Two from Vandal Cave, however, are of soft, white cotton thread, and show no sign of wear, appearing to have been made especially as burial robes.[1]

With the exception of blankets from Ventana Cave, all complete examples are nearly square in shape, or have a slightly greater weft stretch than warp stretch. In this they resemble contemporary blankets. Following are the measurements we have, with the Ventana Cave pieces listed separately:

Catalogue Number	Warp Stretch	Weft Stretch	Source
ASM 18545	34	38	Vandal Cave
ASM 20501	23	40½	Hidden House
ASM 20511	58	64	Hidden House
NPS-AM 954; 4000	20¾	32½	Aztec Monument
UM 29.43.183	44	51½	Lake Canyon
Haury, 1934: 89	39	50	Canyon Creek
Haury, 1945*b*:	54	53	Painted Cave
28–30	*ca.* 54	*ca.* 53	Painted Cave
Burial #11	46 (inc.)	49	Ventana Cave
Burial #22	80¼	29 (inc.)	Ventana Cave
Burial #22	40 (inc.)	27¾	Ventana Cave
Burial #22	48	15	Ventana Cave
	45 (inc.)	15	

(Last 2 are sewed together to make a blanket 30 inches wide)

[1] See Appendix C, chart 15.

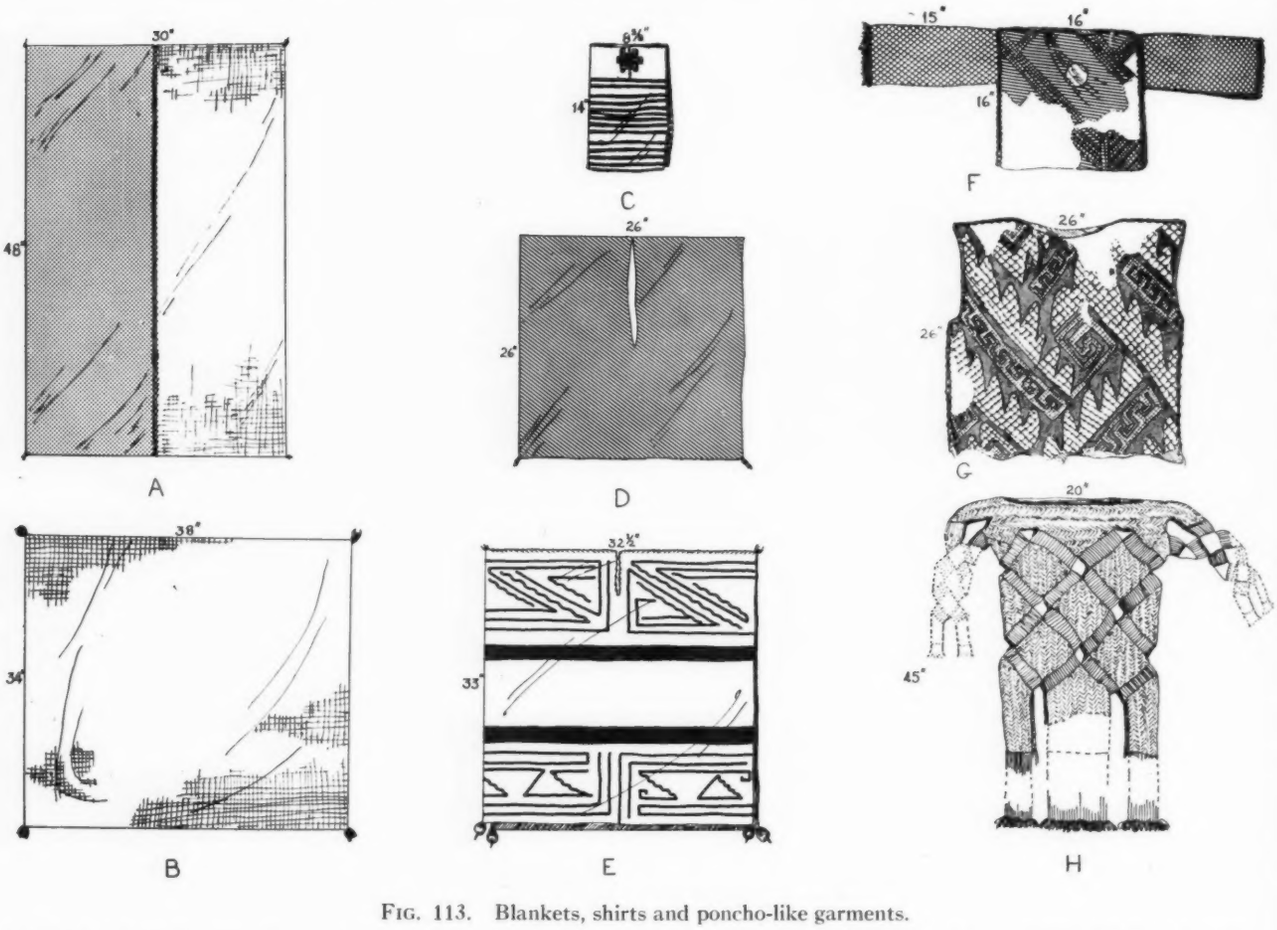


FIG. 113. Blankets, shirts and poncho-like garments.

A. Blanket from Ventana Cave, made by sewing together two narrow cloths—one red and one white. (ASM–VC Burial #22.)
B. Typical Pueblo-type blanket. Vandal Cave. (ASM 18545.)
C. Child's poncho of gauze weave decorated by a weft-wrap openwork design. Ventana Cave. (ASM–VC Burial #22.)
D. An infant's poncho consisting of a rectangular cloth with center slit. Painted Cave. (Haury, 1945*b*: 33, pl. 13*a*.)
E. Sleeveless shirt made from two rectangular cloths sewed along the shoulders, and with painted design. Painted Cave. (Haury, 1945*b*: 30–34, pl. 12.)
F. Painted shirt with sleeves. This article was made from four rectangular cloths, one for the back and one for the front of the shirt, and one for each sleeve. Poncho House. (Guernsey, 1931: 102, pl. 63.)
G. Sleeveless twine-plaited shirt. Tonto. (ASM 13400).
H. Braided shirt. White House. (BM 03.250–1.)

All the Ventana Cave pieces except perhaps the first, were woven as long, relatively narrow rectangles, the longer dimension being the warp stretch. This difference in shape between blankets from central and northern Arizona, and those from the south may indicate a difference in loom type between the regions.

Blankets are generally plain weave—the simplest technique for making large articles. They have selvages consisting of two or three threads twined between the warps and wefts, and there are often short braids or simple tassels at the blanket corners. Most are of plain, white cotton, but judging from the number of dyed plain weave fragments in the collections, the brown blanket from Lake Canyon, and the red cloth in half of one of the Ventana Cave blankets, colored material was also used to some extent.

Blankets, especially among the Anasazi, were sometimes decorated by tie-dye or elaborate painted designs. Anasazi stripe twill cloth was apparently woven into blankets, also, and interlocking diamond twill tapestry was so employed in at least one instance, at Grand Gulch. The more heavily decorated examples are apt to be larger than the plain white ones. They were probably worn as shoulder blankets, hanging free so that the pattern showed, and reserved perhaps for special occasions, whereas the plain white blankets were for everyday use as dresses or small shoulder cloths.

Among the Hohokam weft-wrap openwork designs may have been worked into plain weave blankets. Rag-weft may also have served for coarse blankets outside the Anasazi-Pueblo area.

Blankets are infrequently represented in the Jeddito

murals. Plain black dresses fastened over one shoulder are painted on three figures.[2] One is decorated with white lines. Other black dresses, wrapped about the body beneath the armpits, are also illustrated.[3] Smaller cloths, worn about the shoulders with two corners fastened at the throat and the remainder hanging to the waist in back, are painted in the same number of cases. One is black, the other two are black with decorations of white lines and circles. Negative painting is probably the best explanation for these patterns.[4] There are no depictions of large shoulder blankets. The arms or shoulders are more apt to be covered with a shirt or sleeveless poncho-like cloth.[5]

Cotton blankets used as shoulder cloaks or "mantas" are mentioned by the Spanish in their descriptions of Rio Grande Pueblo, Zuni, and Hopi clothing.[6] Blankets of the Pima in the eighteenth and nineteenth centuries are spoken of only as plain weave, white or red.[7] The one example I have seen is slightly longer (warp-stretch) than wide.

A list of modern Pueblo blankets (cotton and wool) includes the following: *plain weave*, white, brown, black, or checked brown or black and white; *plain weave tapestry*, weft striped; *twill weave*, white, black or dark blue, with plain twill centers and diamond twill borders at top and bottom, and also black or brown and white checked or plaid twill. The upper and lower borders of dresses and shawls are often embroidered in bright colored wool. Painted cloth blankets have gone out of vogue completely, probably owing to the increased importance of embroidered cloth, a convention which started in the north in Pueblo IV. Modern blankets are identical in shape to those woven prehistorically, except for weft striped plain weave tapestry wool cloths intended for use as shoulder blankets or for sale as rugs to tourists.

2. SHIRTS AND PONCHO-LIKE GARMENTS

The collections include a few shirts and sleeveless poncho-like garments designed to cover the body from shoulder to waist or thigh. These were probably worn by men and boys. They were either white, openwork fabrics or plain weave cloth, painted or dyed a solid color.[8]

The most striking examples of the first style are the two complete shirts from White House (BM 03.250–1) and Tonto (ASM 13400). These have several features in common. Both are plaited, rather than loom-woven, one being braided, the other twine-plaited. They are of two-ply white cotton. Both are fringed at the hem line, and decorated by openwork, rather than painted, patterns. (The shirts are fully described on pp. 597–600 and 603–605. See also figs. 108 and 111.)

The child's poncho (fig. 25) from Ventana Cave furnishes a third instance of the use of an openwork fabric for covering the upper part of the body. This garment was made from a rectangular gauze weave cloth 28 inches long (warp-stretch) and 8½ inches wide. Near the middle of the cloth there is a band of plain weave with a unit design in weft-wrap openwork centered upon it. After the cloth was woven, a slit was torn across it from selvage to selvage at one edge of the plain weave section. When the child's head was passed through this slit, the weft-wrap design lay upon his chest. Presumably a belt, worn about the waist, kept the poncho in place. An 8 inch wide weft-wrap openwork cloth from Mule Creek Cave, with edges sewed together, may have been the sleeve of a small garment.

A shirt made from four rectangular plain weave cloths was found in Pueblo III Poncho House, wrapped about the head of a mummy (fig. 113, F). The front and back of the garment are made of cloths 16 inches square. Sewed together at the shoulder, with a slit left for the neck opening, these cloths covered the body to the waist in front and back. They apparently had tassels at their lower corners. Only one tassel remains. The cloths were decorated by negative painting. That is, they were completely covered with brown paint except for a series of small white squares and two large circles, which, left the natural white of the material, form a pattern against the solid ground. Each sleeve is a rectangle about 13 inches wide by 15 inches long, sewed to the body of the shirt at the shoulders. The sleeves are yellowish in color on their outer surfaces, and were apparently once fringed at the wrist. There is no evidence that the edges of shirt or sleeves were sewed together.[9] Kidder and Guernsey remarked on the large number of cut, folded and sewed scraps in Anasazi sites in the Kayenta area. They felt these indicated the use of shirt-like garments.[10] However, it is unlikely that sleeves would have been *cut* and sewed. They were probably woven to shape on the loom and then folded and sewed. There is a sleevelike plain weave object from the Pueblo I Tsegi burial, and a small plain weave sleeve or quiver from Mule Creek Cave (pp. 625–627). These pieces are illustrated in figure 126, B and C. (We have already remarked (p. 508) upon the openwork "sleeve" from the latter site.)

A sleeveless shirt, or poncho, from Painted Cave, was

[2] Smith, 1952*b*: 58, *c*; 72, *b*; 80, *b*.
[3] *Ibid.*, pl. I. See also our fig. 142, G.
[4] *Ibid.*, 81, *a*, *b*; 67, *a*.
[5] *Ibid.*, fig. 24, *a*, *c*, *d*. See also our fig. 142, D. H.
[6] Bolton, 1916: 146, 147, 149, 155, 156, 174, 177. Winship, 1896: 517, 558, 569.
[7] Bartlett, 1854: 224.
[8] See Appendix C, chart 16.
[9] This garment has been described by Guernsey (1931: pl. 63 and p. 102), who considered the painted pieces as shoulder cloths and the plain yellow rectangles as front and back of the shirt. I believe the painting would have been done on the body cloths, where it would show to more advantage. The shape of the yellow rectangular cloths, and the way they are fastened to the others, is almost identical to modern Pueblo shirt sleeves. These cloths, 13 inches wide, would not have covered front and back of the wearer as adequately as the 16-inch painted pieces.
[10] Kidder and Guernsey, 1919: 100.

made from two rectangular plain weave cloths, 32½ by 33 inches in size.[11] These were sewed together along the upper warp selvages, so that one would cover the back, and the other the front, of the body extending over the hips. At the lower corners are fluffy white cotton pompoms. Tassels at the upper corners consist simply of twisted selvage threads. A slit was left at the center of the upper edge of the poncho so that the garment could be slipped over the head. Decoration consists of a simple linear design painted in brown with framing lines of black. Faint patches of pale green color suggest the background may originally have been painted also. The painting is oriented into broad bands at upper and lower borders of the cloth, leaving the center third plain. A belt was probably worn about the waist, covering this undecorated section (figs. 84; 113, E).

A second poncho from Painted Cave[12] was found on the body of a male infant. It is made of a single solid brown plain weave cloth, 26 inches square. A head slit extends from the mid-point of the upper selvage nearly to the center of the piece. The edges of the slit are strengthened by selvage threads, showing that it was constructed while the cloth was on the loom. The poncho was worn over the shoulders, with the head through the slit, and an equal amount of cloth covering the back and front of the body. A belt probably gathered the blanket at the waist and held it in place (fig. 113, D).

The Anasazi stripe twill cloth (NPS–AM 954, 4000) listed with blankets on page 605 has a slit extending into the cloth about 6½ inches from one warp selvage. The edges of the slit have been rolled under and sewed, so that it looks like a neck opening. However, it is not centered on the cloth, and may simply be a mended tear.

Summarizing the data so far presented, we see that at least four types of upper garments (aside from shoulder blankets) were in use in Pueblo III and IV times. *First,* white openwork shirts, either plaited or of weft-wrap openwork cloth, with sleeves or sleeveless like a poncho. *Second,* sleeveless shirts or poncho-like garments made of two rectangular plain weave cloths sewed across the shoulders, and decorated by painting. *Third,* plain weave cloth shirts with separately-woven sleeves and painted designs. *Fourth,* solid color plain weave (and possibly Anasazi-stripe twill weave) ponchos made of a single blanket with a head slit at the center of one warp selvage. Only the first type has so far been found south of the Mogollon Rim—in the form of the plaited shirt from Tonto, the weft-wrap poncho from Ventana Cave, and what *may* be a weft-wrap openwork sleeve from Mule Creek Cave. Solid cloth ponchos and shirts all come from Anasazi sites, as does one braided shirt.

The first two, and possibly the third of these garment types appear in the Jeddito murals, giving us some idea of fashions in late Pueblo IV. Three of the mural figures are shown wearing what appear to be long white shirts, extending to the thighs, and decorated with openwork patterns.[13] Two have long sleeves reaching to the wrist. Arms of the third figure are missing. The fabrics depicted here are probably either braided, twine-plaited, or weft-wrap openwork. I am inclined to believe that the two shirts with sleeves were done by plaiting techniques, since the sleeves extend from the shirts with no break in pattern—as though they had been fashioned as part of the main pieces rather than woven separately and sewed on. However, if these articles were plaited, we would expect fringes at their lower edges. In any event, they do indicate that white lace-like material was considered appropriate for upper garments in Pueblo IV Awatovi, as it had been in the earlier villages of White House and Tonto, among the Hohokam, and *possibly* the Eastern Mogollon (fig. 142, D).

Three of the Jeddito mural figures are clad in dark-colored sleeveless garments covering their bodies from shoulder to upper leg and held in place by wide belts or sashes.[14] These garments are decorated by tie-dye or negative painting with rows of small white squares with center dots, and larger white figures. I think they represent shirts of the type found at Painted Cave, made from two rectangular cloths fastened at the shoulders (fig. 142, H).

The upper part of the bodies of several other Jeddito figures are painted in such a way as to suggest garments of some sort, but Smith does not mention these as shirts, blankets, or ponchos in the text. His figure 51, *a,* may represent a short black blanket extending to the waist. Other drawings show what look like "shirts" with one sleeve only—or waist-length blankets covering one arm, while the other arm and shoulder are left bare.[15] The upper bodies of the center being in Smith's figure 80, *b* and the right hand one in his figure 81, *b* are decorated either by painting, or are covered by short painted shirts with sleeves.

There are Spanish references to shirts worn by Rio Grande Pueblo Indians and at Zuni and Acoma.[16]

At the present time white openwork cotton shirts are knit by the Hopi and crocheted in the Rio Grande Tewa towns. The holes are quite large and the solid areas between them take the form of zigzags and simple geometric figures. Openwork shirts have been identified on several Hopi kachina figures.[17]

There are no painted shirts today, but there is a

[11] Haury, 1945*b*: 30–34 and pl. 12, *b*.
[12] Haury, 1945 *b*: 33 and pl. 13, *a*.
[13] Smith, 1952*b*: fig. 24, *a*, *d*, *k*. See also our fig. 142, D.
[14] Smith, 1952*b*: fig. 50, *c*, and 24, *c*; 88, *c*; 51, *c* and 24, *b*. The last figure shows the sleeveless shirt worn over a white "skirt" which extends below the knees, and is probably a separate kilt. Smith feels the other paintings also represent shirts and separately woven kilts, rather than single garments.
[15] Smith, 1952*b*: figs. 51, *c* and 52, *a*.
[16] Bolton, 1916: 146, 149, 177. Winship, 1896: 549.
[17] Smith, 1952*b*: 282, summarizes these references.

striking resemblance in form and construction between the Poncho House and modern Pueblo shirts. The latter are made of three cloths. A large rectangle with a hole cut at its center for the head, covers the chest and back. To this are sewed two oblong cloths for sleeves. The sides of the shirt and underarm of the sleeves are not sewed, but are held together with ties. There are generally tassels at the lower corners of shirt and sleeves. These garments may be of plain weave white cotton, embroidered in bright-colored wool; of solid black or dark blue plain weave or twill weave wool cloth; or of black or blue and red weft-striped wool cloth. Some of the latter are sleeveless, and resemble the Painted Cave sleeveless shirt in shape, although they are made of a single rectangle of cloth instead of two separate pieces for front and back.[18]

3. KILTS

A kilt is an oblong cloth folded about the hips, with the two short edges meeting along one thigh. It is like a skirt reaching from waist to knee, or somewhat above the knee. Kilts are at present worn by male participants in Pueblo ceremonials. They may formerly have been part of the everyday costume of men in some villages.[19]

There is but one definite prehistoric example of a kilt, the plain weave white cloth with tapestry weave insets from Hidden House (ASM 20493) (fig. 43). Jeddito mural figures furnish ample evidence of the importance of kilts as part of the ceremonial costume of Pueblo IV people in the Hopi Country. Those depicted seem to be decorated by the following techniques: painting with elaborate designs (fig. 142, E); weft-wrap openwork or a plaiting or netting technique (fig. 142, B); plain white with embroidery (?) along the lower edge (figs. 140; 142, I); tie-dyed or painted with embroidery on the border (fig. 140, G); plain white with no decoration (fig. 142, C); tie-dye or negative painting;[20] solid black with embroidery on the lower border;[21] and possibly twill weave with a fancy border (fig. 142, A) and tapestry with interlocked wefts (fig. 142, F). The twenty-three kilts shown in the Kuaua murals are undecorated.[22] Those I have seen are solid black.

Modern dance kilts are plain weave white cotton rectangles with an embroidered band 2 to 5 inches wide along their *short* ends (warp selvages) and only a very narrow line of black embroidery along their lower edges (weft selvages). Sometime between 1500 and 1880 a radical shift in the orientation of embroidery occurred. Smith believes this to be a fairly recent development (*op. cit.*, 273–276). There are some solid dark blue or black wool kilts in use at the present time.

The lack of kilts in Pueblo III Anasazi sites has led to the assumption that they are a non-Pueblo southern trait introduced into northern Arizona and New Mexico after 1300. This is pure conjecture.

4. BREECH COVERINGS

Men's Woven Breech Cloths

Men's breech cloths were made of a narrow strip of material, sometimes fringed at the lower edge. One end of this was fastened to a belt in front while the other end, or the fringe, passed between the legs to be secured to the belt behind. There are twenty-two examples from ten or more sites.[23] With one exception these are characterized by a doubled front section, made by folding on itself 2½ to 6 inches of the cloth at that end. A belt was run through this fold, holding the garment in place at the front of the body.[24] Seventeen of the breech cloths are plain weave, four have twill weave front sections, and one a brocaded weft-float pattern weave front.

Three basic shapes, or styles, have been distinguished. The first is simply a long, narrow unshaped rectangle of cloth with a few inches at one end folded over and sewed for the front section. There are two specimens of this type, both from the vicinity of Camp Verde.[25] They are between 5½ and 6 inches wide. Neither is complete in length at present, but one was at least 24 inches long. Both are plain weave white cloth (fig. 114, B).

The second type consists of a long strip of cloth shaped on the loom so that it narrows gradually from a doubled front section between 5¼ and 8¼ inches wide to a ribbon an inch or less in width. None is complete in length, but one is 67¼ inches long at least. There are eleven examples, one from an unknown site, one each from the Verde Valley, Hidden House, Walnut Canyon, and Wupatki, and six from Tonto.[26] The doubled fronts of all but two (Verde Valley and Hidden House) are "loom-joined" (fig. 115, A, 4). To accomplish this, a length of cloth twice that desired for the front section was woven. The lower edge was then released from the loom bar and the cloth folded over the bar with its lower edge brought up to meet the last weft pick. The next pick of weft included in its passage

[18] For information and illustrations of modern Pueblo shirts see: Douglas, 1939 *a*, *b*, *c*; 1940 *a*, *b*, *c*.

[19] Smith, 1952*b*; 283, quotes Luxán, Espejo, and Obregón as saying of the sixteenth-century Hopi and the men of the Piro villages in the Rio Grande Valley that: "The men cover their privy parts with a blanket similar to a hand towel, painted, and with tassels."

[20] Smith, 1952 *b*: fig. 24, f.

[21] *Ibid.*, fig. 81, *a*, *b*.

[22] *Ibid.*, 273.

[23] See Appendix C, chart 17.

[24] Belts found with breech cloths at Walnut Canyon and Hidden House are warp-face, plain weave ribbons a half to two inches wide. See pp. 529–531.

[25] See Appendix C, chart 17: ASM V–1 and 16231, Camp Verde.

[26] See Appendix C, chart 17: AMNH 14/226, Verde Valley. ASM 16855, Unknown site. ASM 20498, Hidden House. MNA 77/NA405.M227, Wupatki. MNA 561/739.2, Walnut Canyon. NPS–T 9/263, 9/401, 9/407, 9/408, 9/483 and 9/675, Tonto.

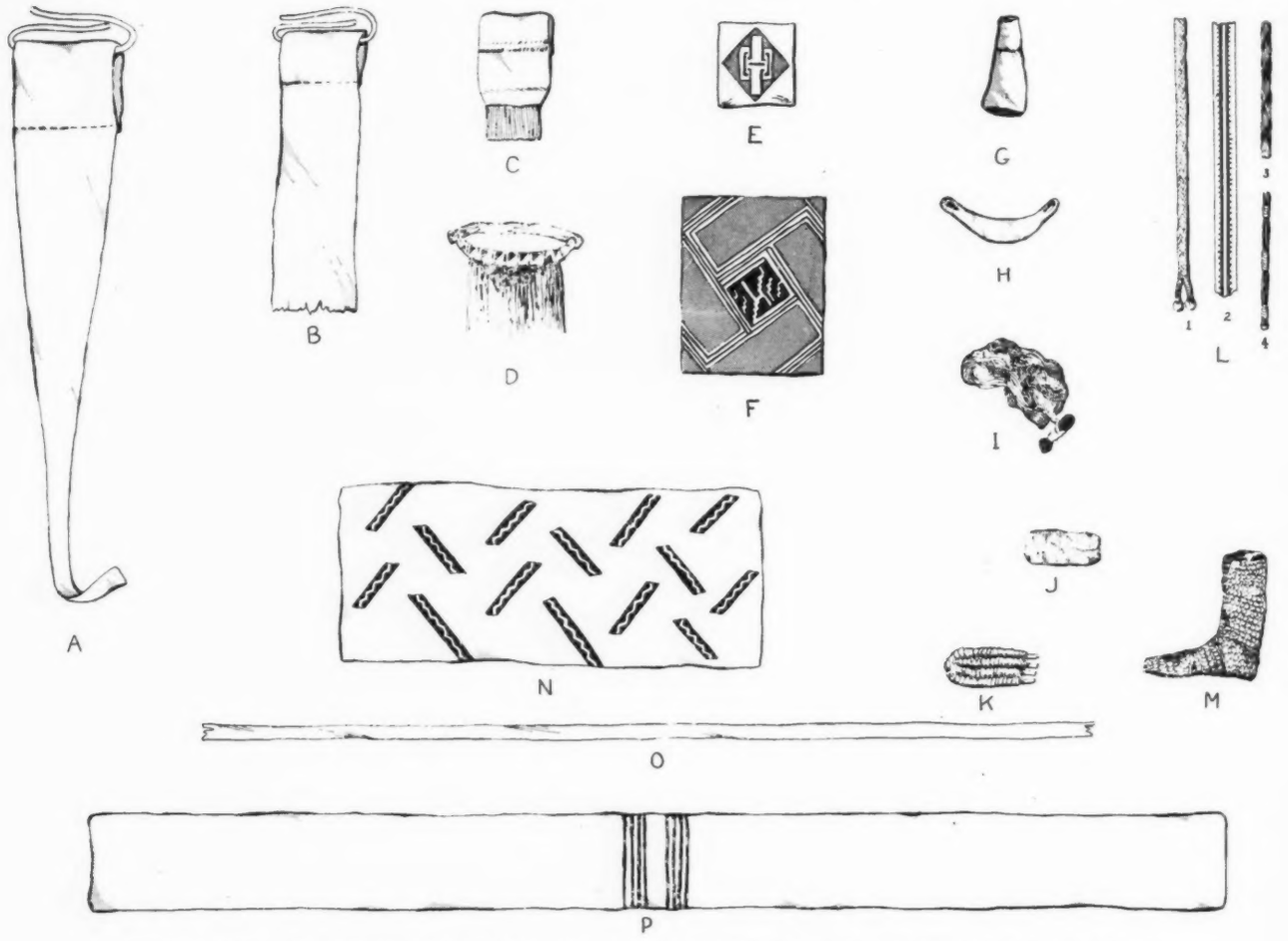


FIG. 114. Miscellaneous articles of clothing. (All articles are shown approximately $\frac{1}{16}$ actual size.)

A. Plain weave breech cloth, loom-joined front fold and narrowed "tail." Camp Verde (ASM 16855)
B Plain weave breech cloth, front folded and sewed, end not narrowed. Camp Verde. (ASM V-1 and 16231.)
C. Fringed breech cloth, front folded and sewed. White House. (AMNH 29.1/7935.)
D. Fringed apron with tapestry weave waist band. Northern Arizona. (ASM 25982.)
E, F. Rectangular cloths of unknown use, with weft-wrap designs. Graham County and Nitsie Canyon. (USNM 363987–8 and ASM 2151.)
G. Small sleeve or quiver. Mule Creek Cave. (PM 97397.)
H. Crescent-shaped tapestry weave article, possibly the front of a woman's apron. Northern Arizona. (ASM 23492.)
I. Turban. Hidden House. (ASM 20496.)
J. Rag-weft pad, possibly a sandal insole. Tonto. (NPS–T R–3.)
K. Sandal sole. Betatakin. (ASM 1031.)
L. Ties and belting. (1) Narrow braid. (2) Warp-patterned belting. Hidden House. (ASM 20498.) (3) Ornamental cord made by braiding around a core. Tonto. (NPS–T R16–15.) (4) Wrapped cord. Montezuma Castle. (NPS–MC 47.)
M. Closed loop shoe-sock. Two Mummy Ruin, Nitsie Canyon. (ASM 1026.)
N. Kilt. Hidden House. (ASM 20493.)
O. Plain weave warp-face belting.
P. Plain weave sash. Lake Canyon. (UM 29.43.181.)

the warp loops along this edge, thus securing the fold. The weave then continued, and the cloth was gradually narrowed by pulling the wefts tight so as to draw warps closer together, and by decreasing the number of warps (fig. 115, A, 5, 6). The latter was done in one of three ways: first, the weft might be broken off, and replaced by an edge warp (6, X); second, an edge warp might be carried into the web for a short distance and then broken off (6, Y); and third, an edge warp might be twisted in with the selvage threads for a few turns and then broken off (6, Z). The result was a narrow ribbon of cloth, the breech cloth "tail." One of these shaped cloths from Tonto has a front panel woven in interlocking twill tapestry (fig. 76, A), the others are plain weave.

The third breech cloth style (fig. 115, B; 116) consists of a short rectangular cloth, folded and sewed on itself to make the doubled front, and fringed along the

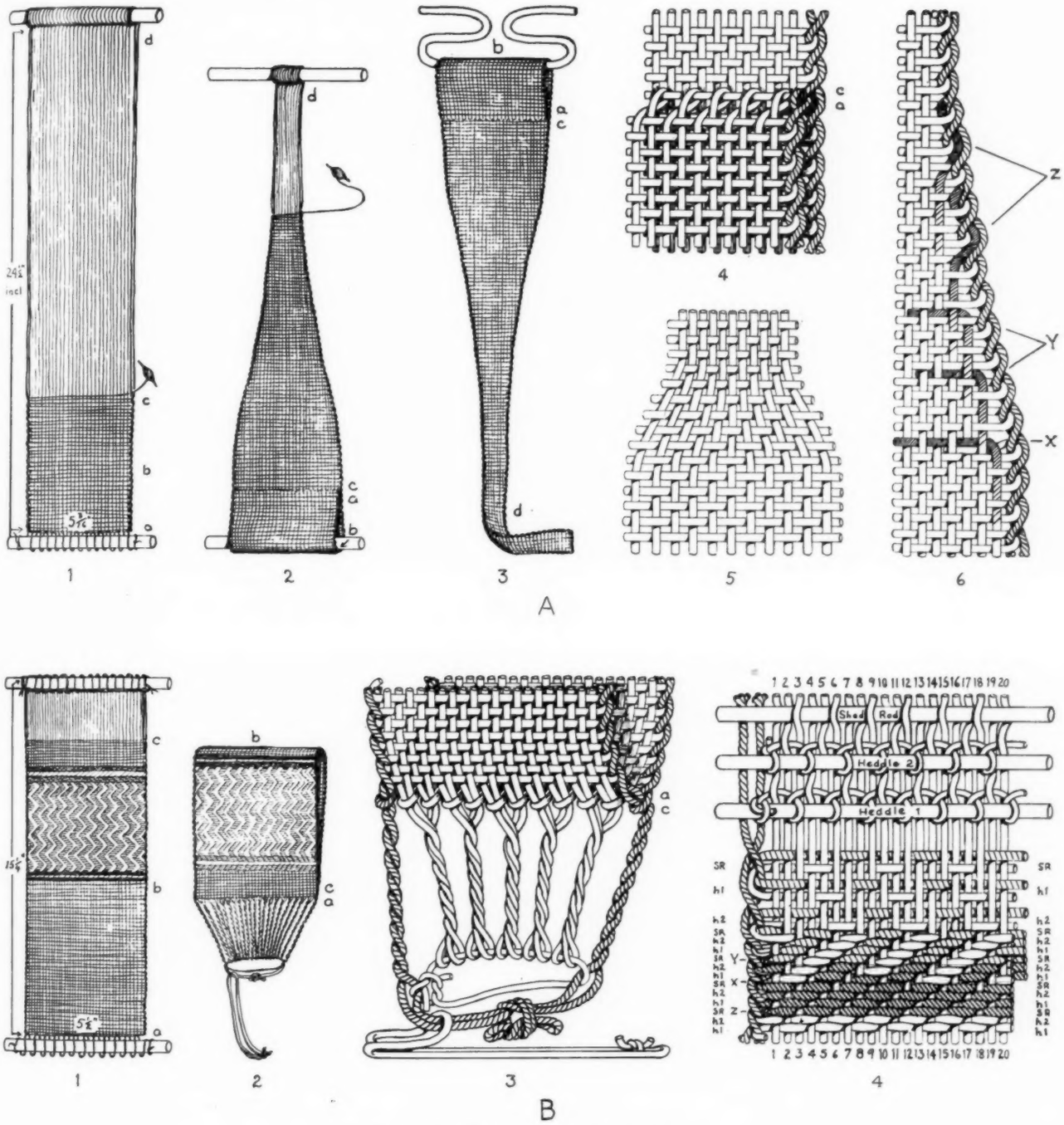


FIG. 115. Two woven breech cloths.

A. Plain weave white breech cloth with front fold secured during weaving, or "loom-joined." Wupatki. (MNA 77/NA405.M227.) (1) Postulated loom set-up for weaving breech cloth. The woven section is to be the folded front of the garment. (2) Position of breech cloth on loom after the lower edge, *a*, has been released from the loom bar, folded over it and fastened to the web at *c*. (3) Completed breech cloth showing narrowed "tail," *d*, and belt run through folded front section at *b*. (4) Detail showing how the warp loops originally along the lower edge of the web, *a*, are caught into the web at *c* in the course of a regular weft pick. (5) Narrowing the cloth for the "tail" section by drawing warps closer together with each weft pick. (6) Other means of narrowing the cloth: *x*, weft broken off and replaced by edge warp; *y*, edge warp carried into web for short distance and then broken off; *z*, edge warp twisted into selvages for a few turns and then broken off.

B. Double-weft twill breech cloth. Gourd Cave. (ASM 2983.) (1) Postulated loom set-up with plain weave and twill sections woven. (2) Completed breech cloth. (3) Detail showing how the unwoven lengths of warp and side selvage cords were passed through the warp loops at the start end of the cloth, *a*, to secure the fold of the cloth. (4) Detail showing double-weft twill technique by which the patterned front of the cloth was woven.

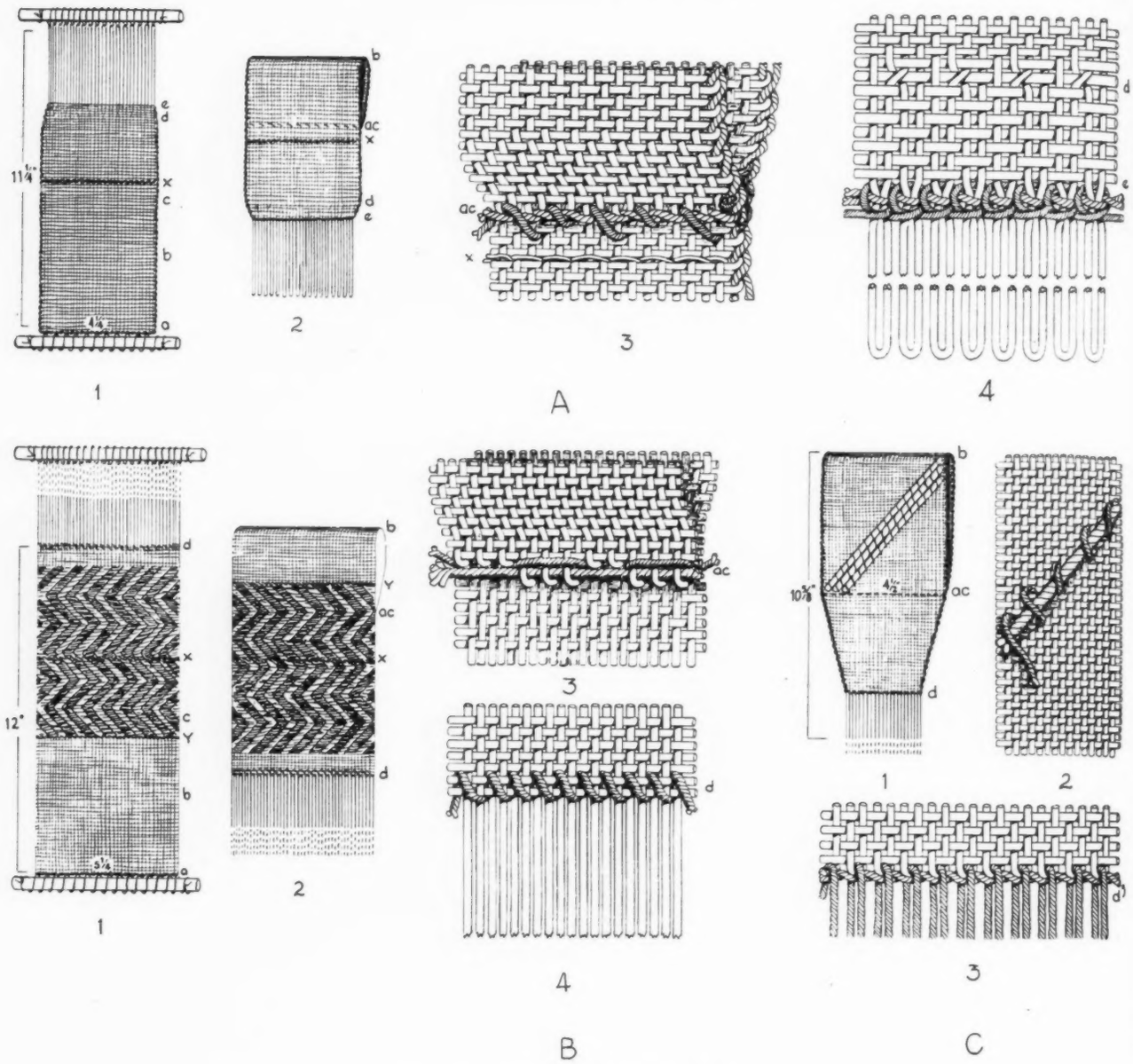


FIG. 116. Three fringed breech cloths.

A. Plain weave breech cloth with front section folded and sewed. White House. (AMNH 29.1/7935.) (1) Probable position of cloth on loom. (2) Completed cloth and fringe. (3) Detail showing the stitch by which the lower edge was secured after the cloth folded. *x* marks a row of twine-stitch inserted, probably, for decorative effect. (4) Detail showing how adjoining warps were crossed a half-turn about each other at *d* and a half inch of over-two under-two plain weave carried out just above the fringe. This was done while the cloth was on the loom, as shown in (1). This drawing also shows the twining and overcasting of threads at the top of the fringe, *e*.

B. Breech cloth with front section woven in reversed twill. White House. (AMNH 29.1/7710.) (1) Probable position of cloth on loom. *x* and *y* mark rows of twine-stitch. (2) Completed cloth. (3) Detail showing the securing of the lower edge to the cloth at *c*. (4) Detail showing the binding thread at the top of the fringe.

C. Breech cloth with front section folded and sewed by running stitches. Three threads are sewed to the front of the cloth, a decorative technique called "couching." Unknown site. (USNM 250178.) (1) Completed cloth. (2) Detail showing couching technique. (3) Detail showing how strings were looped beneath the warp selvage to make a fringe.

lower edge. These cloths are from 4 to 5½ inches wide, and between 6 and 9 inches long, when folded. The fringe along the lower edge is composed either of unwoven warp ends, or of extra cotton threads looped through the cloth above the selvage. The fringe ends of a cloth from Gourd Cave (figs. 75; 115, B) were gathered together and tied to a separate string, which was probably fastened to the belt at the rear of the body.

This may have been the accepted manner of wearing this type of breech cloth.

There are six fringed breech cloths, one from an unknown site, one from Gourd Cave, and the rest from White House. Two other cloths, from Bat Woman House and Floating House, are probably of the same type, although lacking the fringe at present. Of the eight, five are white plain weave cloths, one decorated by couching and the other possibly painted; three have fancy weave front sections, two of which are twill, and the third brocaded weft-float. An Anasazi stripe twill cloth from Mesa Verde measures 6½ inches wide at the warp selvages and narrows to 4½ inches at its torn edge. It is 8¼ inches long at present, and is *not* folded on itself. The shape suggests a breech cloth.[27] A twill fragment from Aztec (CU, no number), 8½ inches wide (complete), may also be a breech cloth, as may the narrow (6½ inches), fringed twill fragment from Wupatki (MNA 77/NA 405.M235).

The construction of the brocaded weft-float breech cloth from White House (BM 03.250–6, p. 560) deserves special attention (figs. 79, 80). Unfortunately it is badly worn at the lower edge, but it appears that the upper and lower warp selvages were brought together here and fastened in some way. A number of coarse two-ply threads loop through the cloth above the selvages and there is a section of plain weave, with two-ply wefts, carried out on these strings. Presumably the string ends below the plain weave were left to form a fringe. It is possible that the strings were in place when the piece was on the loom, running between the upper selvage and the upper loom bar, and that the coarse plain weave was woven at that time. A similar section of heavy plain weave cloth was attached to the warp edge of the warp-float pattern weave (or warp-face twill?) from Tonto described on pages 531–532 (fig. 53, F).

Fringed breech cloths are generally unshaped rectangles, but in one case the cloth narrows slightly between the bottom of the folded front panel and the lower selvage. The piece in question is from an unknown site. It is unique in being decorated by three extra strings appliquéd diagonally across its front, a technique known as "couching" (fig. 116, C; p. 573).

Several facts emerge from this discussion of woven breech cloths. First, that they were generally of undecorated, white plain weave cloth with doubled front sections. When a fancier weave, or a decorative device, was used, it was centered on the outer fold of the front panel. Twill weaves were especially favored for breech cloth fronts. Three types of breech cloths may be distinguished, and on the basis of present evidence, these seem to be regional styles, two being found in Salado-Sinagua territory, and one confined to Anasazi sites. The first—a long, narrow unshaped rectangle of cloth—has been found only in the Upper Verde and probably dates from late Pueblo III or IV. This type may have been a Hohokam fashion. At Tonto, Hidden House, Wupatki and Walnut Canyon the cloths narrowed to a ribbon-like tail, and the front fold was usually completed and secured while the cloth was on the loom. This type may have originated among the Mogollon-Pueblo. For the Pueblo III Anasazi, a shorter cloth with fringed bottom was typical.

Breech cloths were a standard article of male attire in the southwest in early historic times. Those used today by Pueblo men are unshaped rectangles of cloth which fold over a belt before and behind, but do not have permanently sewed front sections. In northern New Mexico they are flannel, wide and very long, reaching nearly to the ground in front and back. Elsewhere they are of commercial white cotton cloth, narrow and short. Until recently they were of native-woven cloth. Several plain weave white cotton breech cloths from Acoma, San Felipe and Jemez have been described.[28] Typical measurements are 81½ by 18 inches and 69 by 16 inches. These cloths have a deep band of embroidery at each end. At Zuni tradition calls for a long white embroidered cotton breech cloth of this nature in one ceremony. Dark blue or black wool breech cloths are also woven. These are twill weave, often with diamond patterned or (at Zuni) dark blue embroidered ends. They are for ceremonial use, and the Hopi also weave them as burial garments for Isleta. They measure about 40 by 16 inches. All native-woven contemorary breech cloths are thus seen to be much wider than prehistoric examples. The rectangular garments from the Upper Verde and the Salado-Sinagua "narrow-tail" cloths may once have been of comparable length, but the fringed Anasazi cloths certainly were not.

Women's Cotton Aprons and Skirts

A number of cotton or part cotton aprons have been found in Anasazi, Salado, and Sinagua villages. They were articles of feminine attire analogous to the woven breech cloths of the men. Those in complete condition have a free-hanging fringe, and it is felt this was true of all described here.

These aprons consist of a narrow waist band with fringe depending from one edge only. They were worn at center front of the body, fastened to a cord or belt that passed about the hips at the rear. There are five all cotton examples, from Kiet Siel, White House, "northern Arizona," Montezuma Castle, and Tonto. A sixth, from Painted Cave, combines cotton and yucca thread.[29]

Most elaborate are the Kiet Siel and "northern Arizona" aprons, with their waist bands of slit and inter-

[27] See Appendix, chart 17: AMNH 29.1/7709, 29.1/7710 and 29.1/7935, White House. ASM 2983, Gourd Cave. BM 03.250–6, White House. CSHS 01461, Mesa Verde. PM 33–62–10/2006, Floating House. USNM 250178, unknown site. UU 1219, Bat Woman House.

[28] Douglas, 1940*a*: 170–171. Mera, 1943: pl. 10.

[29] See Appendix C, chart 18.

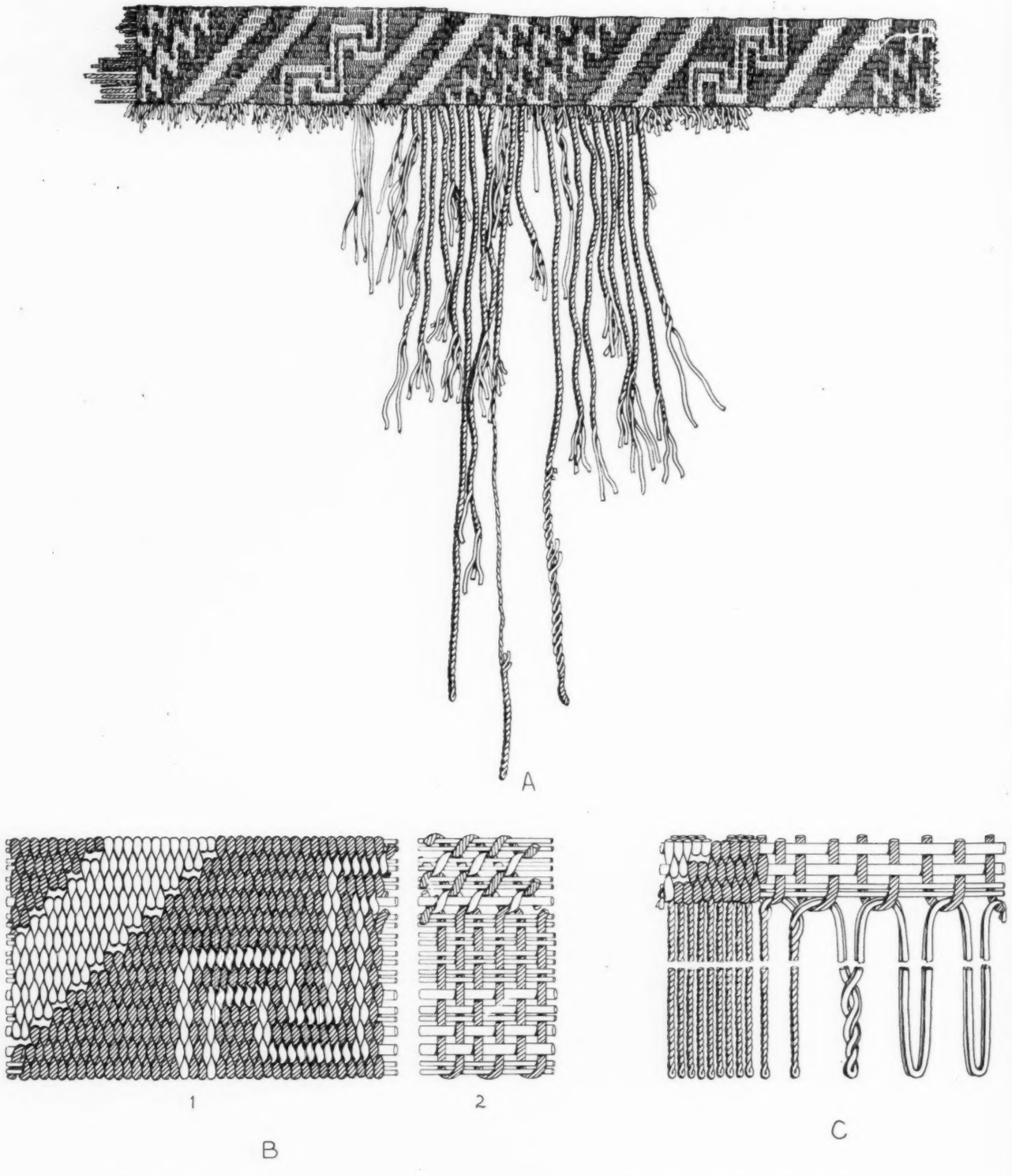


FIG. 117. Fringed apron with plain weave tapestry waist band. Kiet Siel. (MNA 695/NA2519.759.)

A. Apron shown one-half actual size, with design in brown and white wefts.
B. Detail illustrating the composition of the warps and the distribution of slit and interlocking tapestry techniques. The weave is "opened" in (2) to show the interlocking of wefts.
C. Detail of the construction of the fringe.

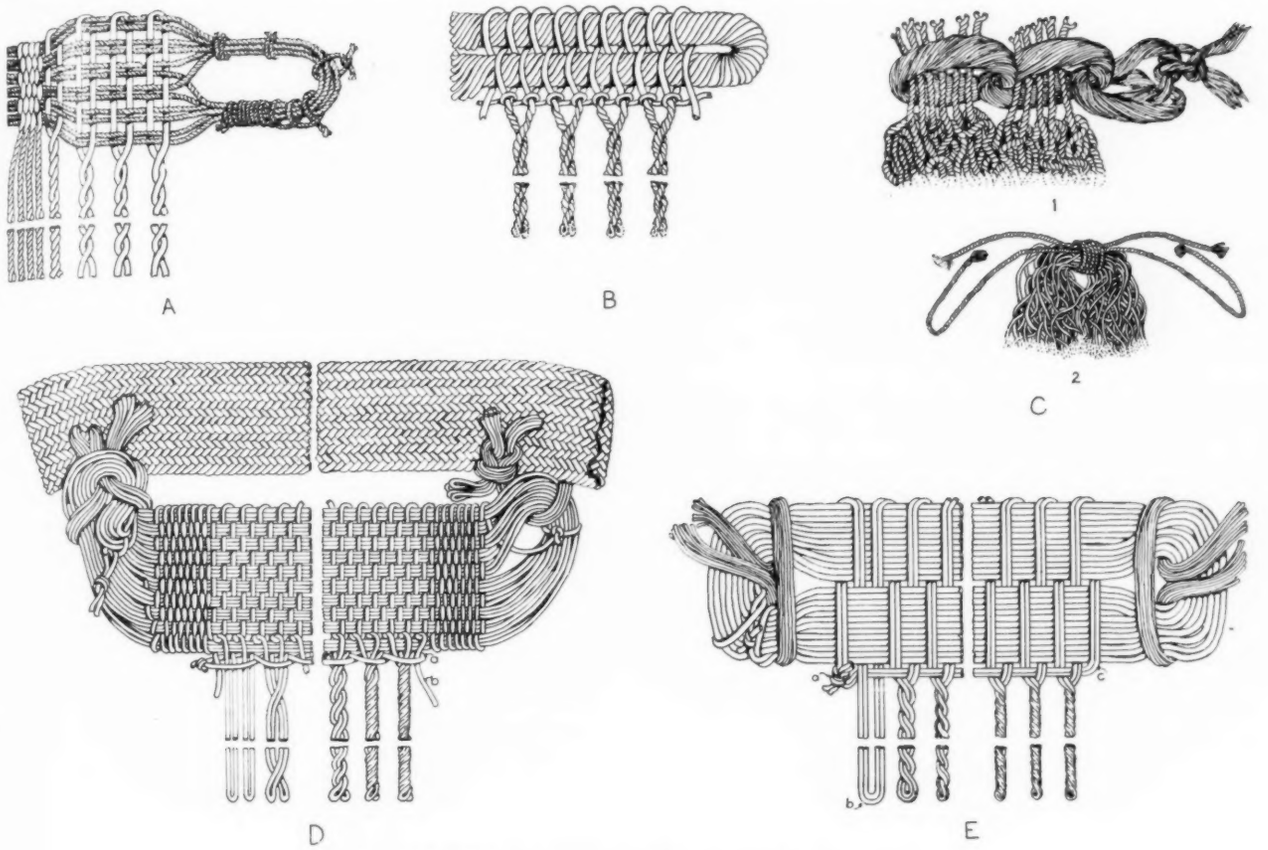


FIG. 118. Fringed aprons and clouts containing cotton.

A. Fringed apron with yucca warps and cotton wefts. Painted Cave. (Haury, 1945*b*: 39–40, fig. 10.) (See fig. 120.)
B. Detail of a crudely made fringed cotton apron from White House. (AMNH 29.1/7569.)
C. Crude clouts containing cotton. Mule Creek Cave. (1) A skein of cotton threads knotted around bunches of apocynum strings. (PM 97414.) (2) Single-ply cotton threads bound at their centers by an eight-strand cotton cord. (Cosgrove, 1947: 68–69.)
D. Child's fringed cotton apron fastened to a flat braid. Northern Arizona. (ASM 25982.) (See fig. 119.)
E. Child's fringed cotton skirt. Tonto. (ASM 13339.)

locking plain weave tapestry, which were described along with other plain tapestry weave articles on page 526. The waist band of the Kiet Siel apron is $1\frac{1}{4}$ inches wide. Along one edge is a fringe of paired cotton threads passed through the weft loops and then twisted together (fig. 117). The longest fringe unit measures $8\frac{5}{8}$ inches. Threads may have been inserted through the weft loops with the help of a needle after the piece was woven. They could as easily have been worked into it during weaving. The northern Arizona apron is illustrated in figures 118, D and 119. The waist band measures $1\frac{1}{4}$ by 9 inches. A fringe 6 inches long was made by passing a two-ply thread over one edge warp (*b*), and through the weft loops. Another thread (*a*), twined through the fringe elements at the edge of the band, served to keep them securely in place. This apron is fastened to a flat braid 1 inch wide and 11 inches long. The garment is of the correct proportions to have been worn by a child.

The waist band of the Painted Cave apron (fig. 118, A; 120) is well made, though not a true tapestry weave and not patterned in any way. The following description of it is given by Haury:

> This piece was constructed by laying up a foundation of six 2-ply cords of yucca fiber. These were doubled back on themselves and tied, making a warp web of 12 elements, $1\frac{1}{2}$ inches wide and 15 inches long. Uniformly and tightly twisted cotton strings were then woven in and out over paired warps and packed tight to make a tapestry weave. The free ends of these were further twisted together to make a single cord. . . . The longest of the pendant strings is 9 inches but it is quite likely that originally they were longer. A piece of yucca fiber string was used as a belt to hold the apron in place.[30]

The fringe of the Painted Cave garment is really an extension of the "weft" threads. In this the apron closely resembles those from White House, Tonto, and Montezuma Castle. The first of these consists of a nine-ply cotton cord doubled so as to make two "warps." Two-ply string, woven over this foundation, is packed tightly together as in tapestry weave, and

[30] Haury, 1945*b*: 39–40.

FIG. 119. Fringed apron with a slit-tapestry weave waist band of brown and white cotton. Length of band, 9″. Northern Arizona. (ASM 25982. Photo by E. B. Sayles.)

extends at least 9 inches from one edge of the cords to make the fringe. The waist band is ¼ inch wide and 11½ inches long (incomplete) (fig. 118, B).

The White House apron was probably constructed in the same way as the skirt from Tonto (fig. 118, E). The waist band of the latter garment, ⅜ inch wide, is a skein of soft, white single-ply cotton threads 12 inches long, separated into two bundles (the "warps") of thirteen threads each. The "weft" is a pair of single-ply yellowish cotton threads, woven over and under the two "warps" starting near one end of the skein at point *a*, and packed closely together. It was allowed to extend 5 inches from the foundation cords along one edge, then turned back and woven between them again. This was repeated until point *c*, near the opposite end of the skein, was reached. The weft was then carried over and under the fringe threads and tied on itself at *a*. There may have been an extra string tied about 5 inches from one edge of the warp skein and parallel to it, over which the weft looped (as at point *b*) as it was carried out to form the fringe. Our drawing shows how weft pairs were subsequently twisted on themselves. Fastened through each end of the skein is a bundle of ten cotton threads which served as ties. The article was found in place on the mummy of an infant about two years of age. It had been folded at the center, passed about the child's waist, and fastened at the right side.[31] It thus served as a skirt, rather than an apron.

The Montezuma Castle apron, not illustrated here, is very like the Tonto garment. The waist band is ¾ inch wide and 9¾ inches long (incomplete), and the maximum length of the fringe at present is 9 inches. A fourteen-strand cord, doubled on itself to make two "warps," comprises the foundation for the waist band. Over this, two-ply cotton string was woven, serving for "weft" and fringe. There is a second apron from Montezuma Castle constructed in the same way, but of yucca and agave fiber threads.[32]

Other Skirts, Aprons and Clouts

Fringed aprons and skirts, much more crudely made than those described above, have been found at Montezuma Castle, Canyon Creek, Tonto, Mule Creek, and Tularosa Caves. These are generally of yucca or apocynum fiber, but a few contain cotton. For this reason, and because they are somewhat comparable to the well-made aprons, they are discussed here.[33]

One type has been well described by Dr. Haury on the basis of an example found about the waist of a female mummy at Canyon Creek.[34] It consists of two parts, each a bulky pad fringed along both edges. One pad was worn in front, the other behind, both secured to a waist cord. The fringe hung down 10 inches in front and 18 inches in back. Such skirts were crudely made of yucca or apocynum fiber strings. There are four examples from Canyon Creek and four from Montezuma Castle. One of the Canyon Creek pieces has a foundation pad of rolled-up strips of cotton cloth. This brings to mind a skirt or apron, similarly constructed, found in the United States National Museum collections. It is from an unknown site (USNM 252209).

Crude string garments from Tularosa and Mule Creek Caves are described by Martin and Cosgrove.[35] The texts do not make it clear whether these were worn with free-hanging fringe as aprons, or with strings drawn between the legs and fastened to a belt at the rear, as breech clouts. Two of the Mule Creek Cave specimens contain cotton, and are illustrated in figure 118, C, 1 and 2. The first consists of a bundle, or skein, of cotton threads knotted around bunches of apocynum strings. These strings hang down in a tangled, matted fringe which is 8 to 10 inches long at present. The center binding is 5 inches wide. Fastened to one end of this is the remains of a waist cord, which consisted of eleven eight-strand cotton strings. The second "apron" is made entirely of cotton. The fringe consists of single-ply threads bound at their centers by five wraps of loosely twisted eight-strand cord. Two waist cords, also of eight-strand cotton string, pass beneath this wrapping. The piece measures 4½ inches wide by 9 inches long (incomplete).

Hough describes a clout on the mummy of a man from Tularosa Cave.[36] This was simply a hank of fiber cords, dyed pink, anchored fore and aft under a waist

[31] With this mummy was also found the twine-plaited shirt described on pp. 603–605.

[32] Kent, 1954.

[33] See Appendix C, chart 19.

[34] Haury, 1934: 63 and pl. XL.

[35] Cosgrove, 1947: 68–69. Martin *et al.*, 1952: 255.

[36] Hough, 1914: 72.

cord. Two hanks of cotton cord, 21½ inches and 17¾ inches long respectively, were found in a site at the head of Tularosa Canyon, and are thought to have served as clouts (USNM 246444).

Dr. Haury found crude clouts on most of the Ventana Cave mummies.[37] One, on a male burial, consists of several strips of cotton cloth, probably salvaged from a worn blanket, tucked before and behind under a belt made of a section of netting. String clouts were found on the mummies of females ranging from five years of age to adults. The clouts consist of a mass of milkweed cordage tucked under a belt at front and back of the body. The belts are bunches of cordage, either cotton or milkweed fiber.

Rectangular Cotton Cloths

A number of complete or nearly complete rectangular cotton cloths have been found at several villages. These are not woven after the fashion of cigaret "sashes," (pp. 619–621). Their use is entirely a matter of guesswork, with the exception of one from Grand Gulch, which has been sewed into the form of a bag (see p. 623). The suggestion is here made that some might have served as aprons, with two corners fastened to a belt at the center front of the body. A rectangular twined-woven human hair apron, measuring 10½ by 9½ inches was found by Guernsey in a Basketmaker II cist in Broken Roof Cave. The cotton cloths *may* represent a carry-over of this type of garment to Pueblo III and IV times. A list of the rectangular cloths found in the collections is given in table 5 (figs. 22, A; 24, A, E; 97, A; 121).

TABLE 5

SMALL RECTANGULAR CLOTHS

Cat. No.	Description	Dimensions	Source
AMNH H/14400	Twill cloth, brocaded weft-float center design. Sewed into bag. (Appendix C, chart 21.)	13¼″×13¼″	Grand Gulch
ASM 2151	Weft-wrap openwork. (Appendix C, chart 4.)	15½″×12½″	Cave Town Ruin
ASM 26236	Weft-wrap openwork. (Appendix C, chart 4.)	15½″×?	Cottonwood
Hough, 1914: 80	Gauze weave. (Appendix C, chart 4.)	5¼″×6″	Solomonsville
MNA 695/NA2519. M337	Twill cloth, brocaded weft-float center design. (Appendix C, chart 8, *a*.)	9″×?	Kiet Siel
PM 33–62–10/2005	Plain weave with 3 bands of heavy decorative wefts. (Appendix C, chart 3, *c*.)	8½″×10½″	Floating House
USNM 363987–8	Weft-wrap openwork. (Appendix C, chart 4.)	6¾″×6¾″	Graham County

FIG. 120. Fringed apron, yucca warps, cotton wefts and fringe. Length of band, 15″. Painted Cave. (Haury, 1945*b*: pl. 15, *a*. Photo by Amerind Foundation.)

Summary of Information on Breech Coverings

Breech coverings of string—worn either as clouts or with free-hanging fringe—had a wide distribution in the prehistoric Southwest. They were apparently a standard article of dress from very early until historic times. I have not attempted to chart their distribution or define the various forms that may have been in use. This lies outside the province of a study of cotton textiles, since most were made of coarse apocynum or yucca fiber, and since they have no relationship to loom weaving. However, we have already noted that Martin found string aprons in Mogollon sites dating between 500 and 1000, and that Cosgrove reported similar finds, and also the use of cotton string for aprons, at Mule Creek Cave, probably around 1100. Fiber string and cotton string clouts of unknown date also come from Tularosa Cave and Tularosa Canyon. String clouts, some including cotton fiber, were plentiful at Ventana Cave (1000–1400). Crude, bulky string skirts were found in Pueblo IV Salado and Sinagua towns. Basketmaker II sites in the Tsegi have yielded aprons with free-hanging fringe, made of human hair, apocynum, yucca, and cedar bark, and associated with female burials. Basketmaker III sites there contain crude clouts made of hanks of string. These measure about 5 by 36 inches, and were used as menstrual pads. A few clouts of this type have been found which have exceptionally well woven front pads of plain weave slit

[37] Haury *et al.*, 1950: 429.

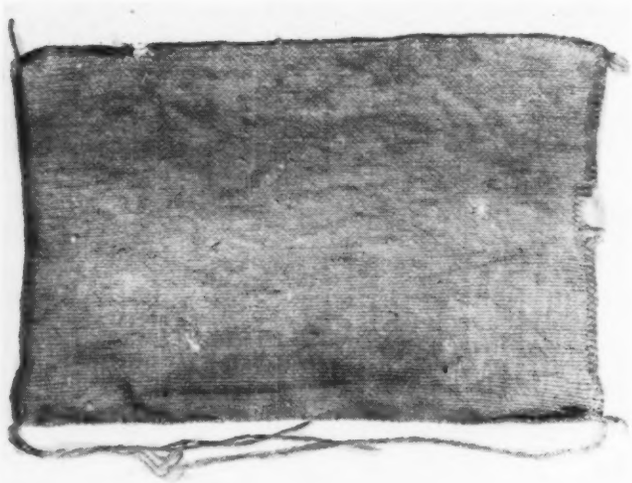


FIG. 121. Plain weave cloth woven after the manner of a cigaret "sash." Width, 8". Bat Cave, Catalina Mountains. (ASM 3089. Photo by E. B. Sayles.)

or interlocking tapestry (fig. 49).[38] I find no mention of crude fiber string aprons or clouts from Anasazi Pueblo-period sites.

Woven cotton breech cloths for men have been reported only from Pueblo III and IV Salado, Sinagua, and Anasazi villages. Well-made cotton or part cotton women's aprons with free-hanging fringe have a similar distribution. Those from Anasazi territory are markedly superior in manufacture, two having patterned tapestry weave waist bands. The use of plain tapestry technique for the apron front among the Pueblo III Anasazi probably reflects a tradition established in Basketmaker III times in the north. Small rectangular cloths *may* have served as aprons to some extent. These have been found in northern and southern sites alike.

5. FOOTGEAR

Footgear was generally made of coarse, durable fiber —yucca, apocynum, or human hair—but cotton was utilized to some extent in this capacity, at least by Pueblo III times. We have already described closed loop shoe-sock uppers (p. 589). Other instances of footgear containing cotton include three sandal soles, sandal ties, and a pad which may be a sandal insole.

There are six examples of shoe-socks made by adding a closed loop upper to a sandal sole. All are from Pueblo III Anasazi sites.[39] In all cases the sock portion is fashioned from warm "wool" yarn made by twisting animal hair between the plies of heavy cotton string (fig. 4, A, 6). Other leggings and socks from the same horizon employ similar yarns combining *yucca* string with animal hair, or yucca string wound with feathers.[40] The aim was to create a warm yarn for winter use, and it was of no particular significance whether cotton or yucca served as the foundation string. As remarked elsewhere (p. 589), the practice of using a net-like fabric for socks and leggings, so firmly established among the Anasazi in Pueblo III times, and probably much earlier, is maintained today among the Pueblo peoples in the form of knitted or crocheted footwear of wool or heavy cotton string.

There are three wickerwork sandal soles, two from Gourd Cave and one from Betatakin, made by working cotton rag wefts over a foundation of four yucca cord warps.[41] The rag strips are an inch or more wide, but packed together so closely that they measure a quarter of an inch or less in the finished piece. In one of the Gourd Cave sandals, the wefts in the heel portion are of crushed yucca leaves, while the ball and toe sections are cotton rag.

Other instances of the use of cotton with relation to footgear include cotton rag strip ties on sandals from Gourd Cave (ASM 2705) and the Kayenta area.[42] Finally, there is a complete rag-weft pad from Tonto, $7\frac{1}{8}$ by $2\frac{3}{4}$ inches in size, which *may* be a sandal insole (NPS–T R–3). The warp is laid up of a continuous yellow yucca fiber string passing back and forth the length of the pad. The fill consists of the same type of thread, plus white and pink cotton rag strips knotted together into one long strand which intertwines with warps in a warp-face plain weave.

6. TIES, BELTS, AND SASHES

Prehistorically, as at the present time, the Pueblo costume required a number of narrow fabrics for use as belting, garters, and hair ties. We have been able to identify a great many of these, made according to several techniques.

In Pueblo III and early IV times, the prevailing fashion for narrow ties one or two inches wide was flat white cotton braids (pp. 593–595). In central, and probably southern, Arizona, these were supplemented by warp-face plain weave belting, sometimes decorated by warp stripe patterns, which served as waist bands for breech cloths, ties for mummy wrappings, and probably also hair ribbons and garters (pp. 529–531). Two examples from Tonto indicate that warp-float pattern weave belting was just beginning to be woven south of the Mogollon Rim in Pueblo IV times (pp. 531–533). It became a very popular technique in northern Mexico at about that time or somewhat later, and had spread to the Hopi country by 1500, as the Jeddito murals indicate (fig. 142, C). Once introduced into the South-

[38] Guernsey, 1931: 76. Guernsey and Kidder, 1921: 45. Kidder and Guernsey, 1919: 157.

[39] See Appendix C, chart 11, *a*: ASM 1026, Two Mummy Ruin. AMNH 29.1/7934, White House. ASM 2768, 3447 and 3448, Gourd Cave. Kidder and Guernsey, 1919: 106 and pl. 40, *a*.

[40] Kidder and Guernsey, 1919: 100–101.

[41] See Appendix C, chart 22: ASM 1031, Betatakin. ASM 2744 and 2767, Gourd Cave.

[42] Kidder and Guernsey, 1919: 107. See also Appendix C, chart 22, PM A1313.

west, it became the belt technique *par excellence* among the Pueblo peoples.

There are isolated examples of narrow textiles produced by certain other techniques. From Tonto and Montezuma Castle come fragile ties an inch or less in width of plain weave slit tapestry (pp. 522–523), and a ribbon from the former site was fashioned in counter-paired warp-twine (pp. 579–583). A good many narrow belts of unidentifiable technique are depicted in the Jeddito murals.[43]

Wider sashes were woven in plain weave, as the complete piece from Lake Canyon shows (fig. 12). Narrow cloths with ends patterned in fancy weaves may be sash ends (figs. 55, 71). The narrow gauze weave band from Tonto, decorated with weft-wrap openwork patterns at the ends, was probably a sash.[44] Two of the McEuen Cave nets and the cotton net from Tularosa Cave probably served in this capacity (p. 592).

We may distinguish several classes of narrow fabrics used in historic Pueblo costume. Everyday belts for women are traditionally woven in warp-face plain weave with center panels of warp-float pattern weave. Smaller bands of the same weave serve as garters for the men, being worn about the leg just below the knee to hold the leggings in place. Still smaller warp-face ribbons are used by the men as hair ties. Warp-face, generally with warp-stripe patterns, are woven by several Rio Grande Pueblos for tourist sale (p. 535). Elsewhere in the Southwest warp-float belts have been woven in historic times by Navaho, Maricopa, and probably Pima, Papago, and Opata.

Wide, flat braided white cotton sashes with heavy fringing are still required for the Hopi bride's costume, and are woven by the Hopi and in several Rio Grande towns. Occasionally one finds a wide white sash of this type fashioned in plain weave or twill, instead of the traditional braid technique (see pp. 600–603 for a discussion of the origin and history of wedding or rain sashes.)

Sashes for use with dance costumes are white plain weave cloth with ends decorated by "brocade" worked in colored wool yearns. In my opinion, this technique has supplanted the Pueblo III and IV practice of decorating sash ends with interlocking twill and possibly embroidery, true brocade and other fancy weaves. Oddly enough, no woven sashes with patterned ends are shown in the Jeddito murals.

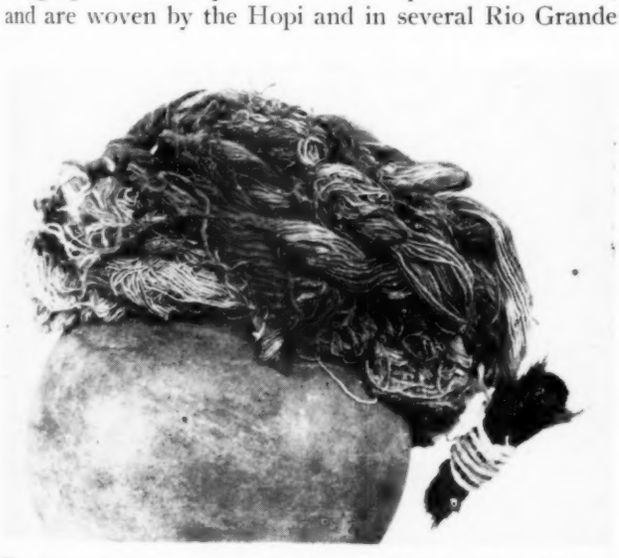


FIG. 122. Turban composed of hanks of white, red, and brown cotton yarn. The knot of hair to which it was attached is shown at right. Diameter at lower edge, 10". Hidden House. (ASM 20496. Photo by E. B. Sayles.)

[43] Smith, 1952*b*, fig. 26.

[44] Haury, 1934: 97, pl. LX, *b*.

7. TURBAN

A curious sort of turban was found on the head of the Hidden House mummy (Appendix B, chart 1, p. 663; fig. 122). This is composed of loosely twisted hanks of cotton yarn containing in all about forty single-ply threads, white, brown, and red in color. The hanks were wound round and round upon themselves, spiralling up in a kind of bowl-shaped cap 3¼ inches high. The bottom of the turban is about 10 inches in diameter. A cord consisting of four two-ply cotton threads runs through the center of the turban. This was wrapped and tied around a knot of hair at the rear of the head, thus fastening the article in place. There is no other head covering of cotton in the collections.

OTHER USES

1. WRAPPINGS ON PRAYER STICKS, CANE CIGARETS AND OTHER CEREMONIAL OBJECTS

Ceremonial regalia in prehistoric sites generally includes small sticks of various types called "prayer sticks" or "pahos." In some instances these have been wrapped with cotton string (fig. 124, A).[45] Also widely distributed archaeologically are small cigarets made of sections of cane. Some of these are bound with cotton cord at their centers[46] (fig. 124, D). Others are wrapped in miniature cotton cloth "sashes" or "blankets." This latter treatment, according to Haury, is: "Pretty closely confined to caves of the Gila Basin, and may therefore be Hohokam, while cane cigarets without this feature are widely used among the Pueblos."[47] Haury describes and illustrates woven cloth sashes from Double Butte Cave southwest of Tempe. His drawing of one is reproduced in our figure 124, G, and his description of the process probably used in manufacturing it follows:

> On a frame, or to two rigid side pieces, there were fastened two pairs of strings from ½ to ¾ inch apart and about eight inches long. Although these strings were double, they were not twisted into a single yarn. . . . Next to one of these

[45] See Appendix C, chart 23: Cosgrove, 1947: 126, fig. 119, Mule Creek Cave. MNA no number, Kiet Siel?

[46] See Appendix C, chart 23: Fulton, 1941: 23–24, pl. VI, Winchester Cave. Martin *et al.*, 1952: 351–354, Tularosa Cave.

[47] Haury, 1945*a*: 193.

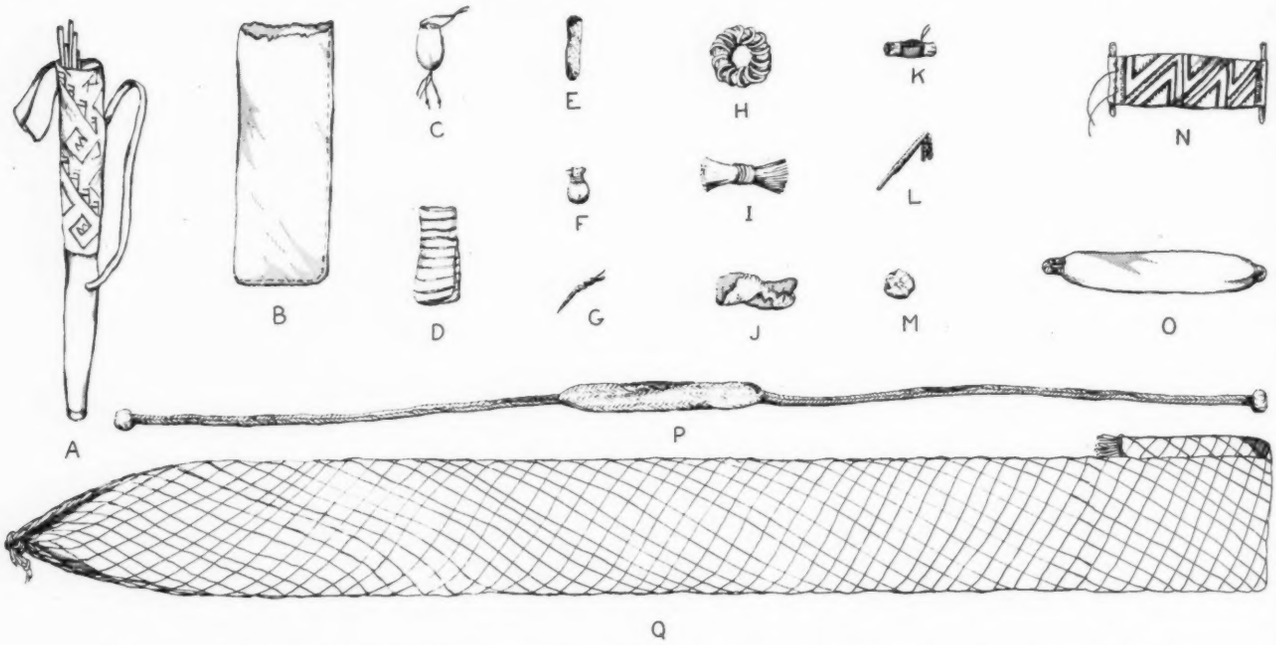


FIG. 123. Bags, nets, and other articles utilizing cotton. (All articles are shown approximately $\frac{1}{16}$ actual size.)

A. Quiver. Hidden House. (ASM 20491.)
B. Plain weave bag. Hidden House. (ASM 20494.)
C. Closed loop bag. Gourd Cave. (ASM 1983.)
D. Anasazi stripe twill bag. Southwestern Colorado. (UM 29.43.153.)
E. Finger twill sack. Sunflower Cave, Marsh Pass.
F. Small bag made from a square of cloth. Frijoles Canyon.
G. Yucca leaf tip needle with cotton thread. Northern Arizona.
H. Pot rest of yucca leaves, cotton cloth and cotton cord. McEuen Cave.
I. Bundle of rushes bound with cotton string. Canyon Creek Ruin.
J. Wooden pillow wrapped with cotton cloth. Ventana Cave.
K. Cane cigaret with miniature "sash" or "blanket." Southern Arizona.
L. Prayer stick wrapped with cotton string. Kiet Siel.
M. Paired sherd disks bound with cotton string. Winchester Cave.
N. Cradle band of plain weave tapestry. Small ruin near Inscription House. (ASM 2775.)
O. Carrying band. Aztec. (AMNH 29.0/9975.)
P. Carrying band or sling. White House. (AMNH 29.1/7994.)
Q. Net. McEuen Cave. (GP #116.)

strings, destined to form the end selvage of the fabric, there was tied another yarn . . . for stretching the warp web. This yarn was carried across to the other basic yarn around which it made a complete turn before returning to the starting yarn. The process was then repeated until the warp was stretched to the desired width, this usually being about 2 inches. It will be noted that the warp runs the short dimension of the fabric. When a sufficient width of warp had been stretched, the same yarn was doubled back and woven into the warp, now as the weftage, . . . and carried on through until the fabric was finished. . . . Thus miniature sashes were made of a single yarn, excepting the 2-paired foundation cords.[48]

The foundation cords in our drawing are lettered *a* and the warp-weft thread is tied on at point *b*. This seems to have been the standard procedure for manufacturing sashes. Interestingly enough, although warp and weft are one continuous yarn the wefts generally appear to be softer and thicker than the warps, as in the case of regular loom-woven plain weaves. This must result from the tension to which warps were subjected in weaving.

The Double Butte Cave sashes are about $\frac{1}{2}$ to $\frac{3}{4}$ inch in "warp stretch" by 2 inches in "weft stretch." A slightly larger piece from that site measures $\frac{7}{8}$ by $2\frac{1}{2}$ inches and is woven in over-two under-two reversed twill with blue wefts. I have seen three cane cigarets with similar sashes from a cave in Hieroglyphic Pass near Sacaton. Two of these measure about $\frac{7}{8}$ by 2 inches, and a larger example is 3 by $3\frac{3}{4}$ inches (fig. 124, E).

An incomplete rectangular cloth from Wupatki, measuring 7 by 3 inches, was woven after the manner of the miniature sashes, with warp continuing as weftage. The wefts have been inserted in a very irregular twill rhythm. There are two broad, black weft stripes. Black thread was fastened to white where needed by simply twisting the thread ends together. No knots

[48] *Ibid.*, 202 and pl. 87–90.

were used (fig. 124, F). This piece may have been a cigaret sash, or may be another of the rectangular cloths of unknown use listed in table 5, page 617. The latter, it should be noted, were woven after the manner of regular loom material, with separate warp and weft threads and side selvage cords.

Other sash-wrapped cigarets come from a cave northeast of Olberg at the edge of the Pima Reservation. One of these is embroidered in blue and brown threads (fig. 30, A). Hough found cigarets with sashes in a cave near Phoenix and in the Upper Gila region.[49]

The caves from which cigarets and prayer sticks come apparently served as religious shrines. The findings are difficult, in many cases impossible, to date. Haury believes the Double Butte material to be pre-Spanish, since no objects of European manufacture were found. Martin's Tularosa Cave specimens were found in levels dating between 700 and 1100. According to the Pima, the cave near Olberg was used as a shrine in the past and at times is still so used. The material from it that I have seen is definitely native-spun and woven cotton, but it would be impossible to say how old it is.[50]

Other ceremonial objects utilizing cotton include a bundle of rushes tied together with brown, yellow, and black string from Canyon Creek Ruin, a corn cob wrapped with plain weave cotton cloth and tied with a black string from Kiet Siel (fig. 124, B), and the paired sherd disks bound with cotton string from Winchester Cave (fig. 124, C).[51] There are undoubtedly additional instances of the ceremonial use of cotton which I have not observed in the collections. Cotton is important in Pueblo religious ritual today and small amounts of it were grown until recently at several conservative towns expressly to supply ceremonial needs.

2. CARRYING BANDS OR TUMP LINES

Sturdy bands, designed to aid in carrying heavy burdens, have been described on pages 524–526, 583. Thirteen are plain weave tapestry with yucca warps and cotton wefts. Five or six were made by twining in pairs of wefts instead of weaving in single threads. It has been shown that tump lines were made with no apparent change in technique from Basket-maker II into Pueblo IV times by Anasazi, Sinagua, and Salado. That is, they were woven on a skein of warps looped between two supports, and are not to be considered loom-woven cloths.

3. CRADLE BANDS

The term "cradle band" is applied to any soft, relatively broad band of material serving to hold a baby in his cradle. This was passed across the infant's stomach, probably outside the other wrappings, and its ends were secured to the sides of the cradle by short, toggle-like sticks from 5 to 7 inches long. Bands are from 12 to 16 inches long and 3 to 6 inches broad.[52] The collections include nine pieces which may be identified with reasonable certainty as cradle bands.[53] Four are plain weave tapestry, and are described on pages 523–524. One is the fragment of brocade attached to a small stick and found with an infant burial in Canyon Creek Ruin (p. 512). Another is a section of over-two, under-two flat white braid, $3\frac{1}{4}$ inches wide and $13\frac{3}{4}$ inches long. Each end of this is cut straight across and sewed over a small stick. The piece is from an unknown site, probably in northern Arizona. A second braided cradle band is the brown and white wool plaid from Painted Cave. It is composed of two $1\frac{1}{2}$ inches wide sections of belting, 17 inches long, sewed together into a band 3 inches wide. Cotton yarn was used to join the two pieces together and to tack the belting over the end sticks (fig. 110). Finally, there are two cradle bands fashioned from bits of plain weave white cotton cloth, one from Grand Gulch and the other from Canyon del Muerto. It will be noted that five of the bands are definitely of Anasazi origin and two more probably so. The others are from Palatki and Canyon Creek, or Sinagua and Salado sites. The bands are accessories of the Pueblo-type cradle.

4. BAGS

Techniques

Thirty-four specimens have been identified with reasonable assurance as bags.[54] These were fashioned from cloth woven in nine different techniques, as follows:

Plain weave	19 bags
Weaving on a cylinder of warps	6 bags
Closed loop	3 bags
Twill weave	1 bag
Twill weave, brocaded weft-float center design	1 bag
Brocade	1 bag
Weft-float pattern weave	1 bag
Braid	1 bag
Weft-wrap openwork	1 bag
Total	34 bags

All except plain weave bags have already been described in some detail (see page and figure numbers on chart 21). Two types of plain weave containers may be distinguished. One was made from a scrap of cloth 2 or 3 inches square by drawing the corners to-

[49] See Appendix C, chart 23: MNA 554/2716. Hieroglyphic Pass Cave. MNA NPS/NA405R7B27, Wupatki. Private Collection, no numbers, cave near Olberg. Haury, 1945*a*: 202, pls. 87–88, 89–90, Double Butte Cave. Hough, 1914: 80, 107–111, fig. 167, Cave near Phoenix and Upper Gila.

[50] Information about this cave was given me by Gwyneth Harrington, Tucson, Arizona.

[51] See Appendix C, chart 23: Fulton, 1941: 23–24, pl. VII, Winchester Cave. Haury, 1934: pl. LXIX, Canyon Creek. MNA 695/NA2519.261, Kiet Siel.

[52] For a good description of a Pueblo III cradle, this one with a band of feather string, see: Guernsey, 1931: 105–106, pl. 64.

[53] See Appendix C, chart 20.

[54] See Appendix C, chart 21.

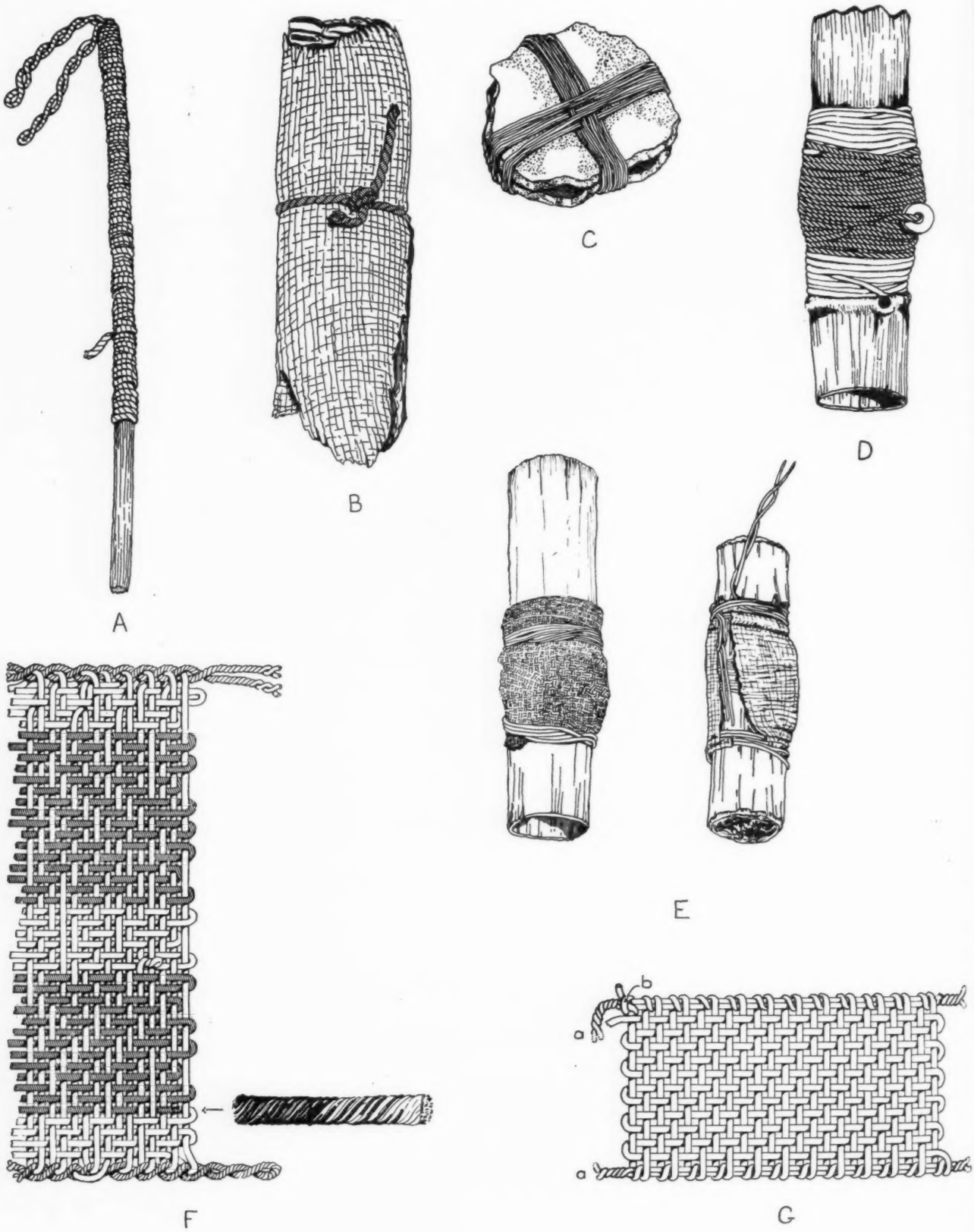


FIG. 124. Some uses of cotton for ceremonial objects.

gether and wrapping a cotton or yucca string about the folds beneath them (fig. 97, B). There are three of these, one from a site near Flagstaff, one from Frijoles Canyon, and one from the Salt River Valley. These may have been torn from larger cloths. For example, the wrapping on the agave stalk medicine box from Hidden House was tied off into a ½-inch-wide "ball" at one point. Inside this is a white, clay-like substance. If the "ball" were torn from the larger cloth it would look exactly like the small "bags" we have described.

The second type of plain weave bag was made by folding and sewing cloths generally torn or cut from larger pieces of material. (This is an exception to the usual practice of weaving cloth to shape on the loom.) Seaming was done with cotton or yucca string, usually in a haphazard manner. Overcasting or running stitches were used. Seams were sometimes turned in, sometimes allowed to remain on the surface of the bag. Occasionally there is evidence of a drawstring run through the material at the mouth of the container. One bag, from Southwestern Colorado (UM 29.43.-154), was dyed reddish-brown and decorated by fastening a pair of cotton-string balls (see p. 579) at each side seam. The balls are about ⅜ inch in diameter. Two others, from the same locale (UM 29.43.118 and 29.43.155), also show the use of color. One was dyed yellow-brown, and the other had probably been rubbed with red paint. The remaining plain weave bags are white, with no evidence of decoration.

Sizes

Loom-woven cloth bags vary considerably in size, presumably in accordance with their intended usage. The smallest I have recorded (aside from the small squares of plain weave), from Olla House (PM A1562), is of plain weave, 3¼ inches in length (incomplete) by 1¾ inches in width. The largest, from Hidden House (ASM 20494), is made from a plain weave cloth with a warp stretch of 16 inches and a weft stretch of at least 23 inches. This was folded to make a bag 8 inches wide, the two warp selvages being brought together and sewed with yucca (?) thread in simple running stitches about ¼ inch long. Similar stitching closes the bottom of the bag. Two other bag fragments may have been comparable to this in size. One, also from Hidden House (ASM 20506), is 7 inches wide, the other, from Tonto (NPS–T 9/262), is 9¾ inches wide by 14¼ inches long (incomplete). The majority of examples fall somewhere between these extremes in size, averaging from 4 to 8½ inches long, and 2½ to 3½ inches wide. The Montezuma Castle weft-float pattern weave bag (figs. 77, 78), 12½ by 5¾ inches, is only slightly above the average. The 13¼-inch square of twill weave cloth with brocaded weft-float pattern weave center from Grand Gulch (AMNH H/14400) is unlike any of the other containers. The cloth was gathered at each end by a cotton string, and one end and side were bound to the edge of a 1½-inch-wide flat braid. Incomplete in length, the braid may once have passed around the other end and side. If so, the object would have resembled, in shape and design, a twill-plaited ring basket.

Cotton bags fashioned in non-loom weaves tend to be smaller in size than the above. The little sacks con-

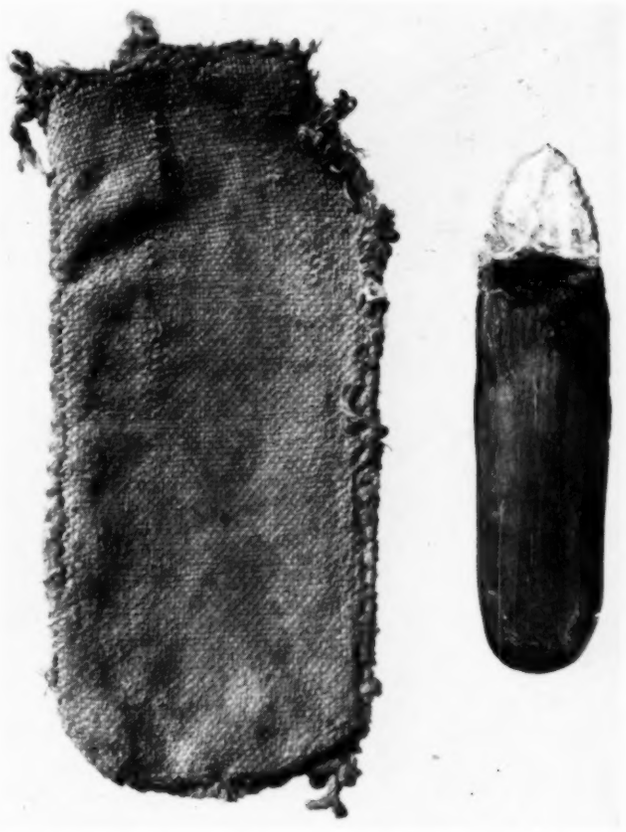


FIG. 125. Knife pouch. Length, 6½". Southwestern Colorado. (UM 29.43.118.) Knife of the type for which such pouches were probably made. Southeastern Utah. (UM 29.42.668. Photo by University Museum.)

FIG. 124.

A. Prayer stick, probably from Kiet Siel. (MNA, no number.)
B. Corn cob wrapped in cotton cloth and tied with a black cotton string. Kiet Siel. (MNA 695/NA2519.261.)
C. Two disk-shaped sherds wrapped with cotton thread. Winchester Cave. (Fulton, 1941: pl. VII.)
D. Cane cigaret wrapped with cotton string. A turquoise bead is attached to the wrapping. Winchester Cave. (Fulton, 1941: pl. VI, *b*.)
E. Two cane cigarets wrapped in cloth "sashes" or "blankets" woven especially for this purpose. Hieroglyphic Pass. (MNA 554/2716.)
F. Detail of one edge of a twill weave cigaret "sash" from Wupatki, showing how warps turn back into the web to become wefts. Irregularities in the twill pattern probably represent mistakes caused by the fact that heddles were not used. Notice also the error in warp manipulation at the upper selvage. 7" × 3". (MNA NPS/NA405R7B27.)
G. The construction of a plain weave "sash" from Double Butte Cave. About 2" wide. (Haury, 1945*a*: 202.)

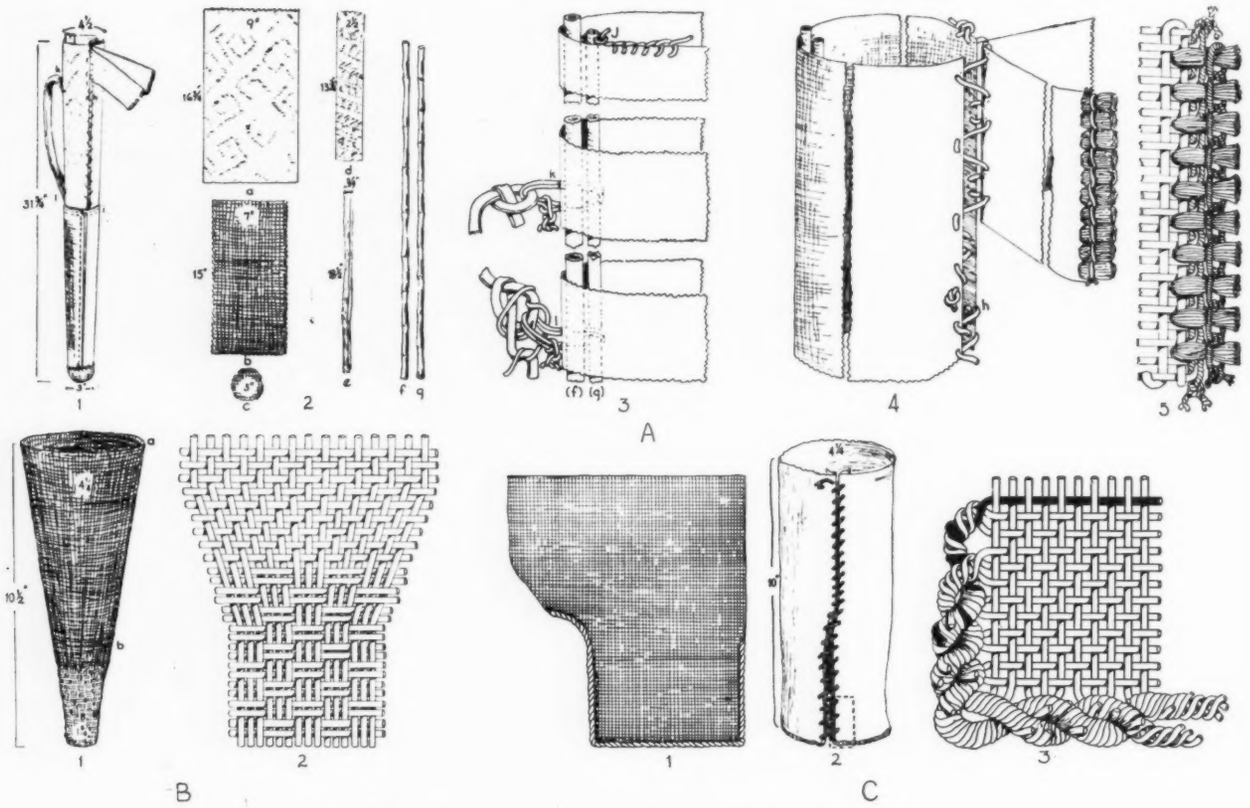


FIG. 126. The construction of quivers and a sleeve-like object.

A. Plain weave tapestry quiver from Hidden House. (ASM 20491.) (1) A diagram of the complete quiver. (2) The five cloths and two cane rods from which the quiver was made. (3) Details of the fastening of rod *g* to the rim of the quiver at *j*, and the tying in of the carrying strap at points *k* and *l*. (4) Method of fastening the tab to the body of the quiver. (5) Detail of the construction of the fringe on the quiver tab.

B. Small quiver (?) from Mule Creek Cave. (PM 97397.) (1) Diagram of the quiver. (2) Detail of the "cuff" at the narrow end of the quiver.

C. Sleeve-like article from a Pueblo I burial in the Middle Tsegi. (PM A5057.) (1) Shape of the cloth before sewing. (2) The cloth with edges sewed together. (3) Detail of treatment of torn warp and weft edges, with one weft shaded so that its movements may be easily traced.

structed on a cylinder of warps (NPS–T 9/60, 9/61, 9/62, Tonto; PM–A 1848, 1849, 1850, Sunflower Cave), are between $\frac{3}{4}$ and 2 inches in diameter and probably were about 5 inches long originally. The Grand Gulch bag made from a section of flat braid (AMNH H/12-260) is an inch wide. A complete closed loop bag from Gourd Cave (ASM 1983) is $3\frac{1}{2}$ inches long by $1\frac{3}{4}$ inches wide, and a fragmentary bag from the same site (ASM 3017), similarly constructed, is $\frac{3}{4}$ inch wide and at least 4 inches long. Other closed loop containers were found in Navaho National Monument (USNM 270.244). I have no record of their sizes.

Uses of Bags

It is not possible, of course, to determine the use made of every bag. However, the contents of several have been preserved, and these are nearly all of a ceremonial nature.

Two pouches in the University Museum collections from Southwestern Colorado (UM 29.43.118 and 29.-43.153) are listed as knife cases. One is illustrated in figure 125, with the type of knife it is supposed to have contained. Actually, the bag and knife were not found together, and the identification of these articles as knife cases is open to question. A stone knife was found in a closed loop container from Navaho National Monument (USNM 270.244).

Some of the contents of the tiny Sunflower Cave cylindrical sacks are listed on page 586, and the closed loop bag from Gourd Cave, with the stones it contained, is shown in figure 100. This was found buried some 18 inches below the hearth in Room 12 of the site, along with other materials including a plain weave cloth bag (ASM 2005). The latter contained a bundle of 432 threads looped through a cord as though in preparation for braiding, six small stone cylinders, and seven pieces of root. Articles listed in the files as "medicine pouches" were found in a cloth bag from Southwestern Colorado (UM 29.43.155), and one from Zele Cave contained feathers. Feathers and prayer sticks were

present in closed loop bags from Navaho National Monument (USNM 270.244).

Apart from their use as containers for ceremonial articles, bags probably also served to hold seeds being saved for planting. Squash seeds were found in plain weave sacks from Canyon Creek (Haury, 1934; pl. XLVIII) and McEuen Cave (GP 113). The latter also contained a small piece of malachite.

5. QUIVERS

Actually bags made to conform to a particular usage, there are two quivers from Hidden House and a third object which may be a quiver from Mule Creek Cave.[55] One of the Hidden House quivers is complete (ASM 20491) and contained twelve arrows when found (figs. 39–41). The construction of this piece is shown diagrammatically in figure 126, A. It was made from five separate cloths and two hollow cane rods. The upper half is a plain weave tapestry cloth (*a*), 9 inches wide (complete) and 16¾ inches long from one warp selvage to a torn edge. The lower half is a plain weave cloth (*b*), 7 inches wide (complete) and 15 inches long, with only one warp selvage remaining. The toe was fashioned from a circular scrap of plain weave about 3 inches in diameter (*c*). A strip of tapestry cloth, 13¾ inches long by 2¼ inches wide (*d*), was fastened at the upper edge for a decorative tab. Finally, a carrying strap by which the quiver could be slung over the shoulder, was added. This is a band of warp-face plain weave 18½ inches long (incomplete) by ¾ inches wide (*e*). Basic in the construction of the quiver were the two hollow cane rods (*f* and *g*) which served to hold it rigid.

The manner in which these several pieces were joined together into a quiver may be briefly outlined. The cloth forming the lower half of the piece was folded lengthwise, and its weft edges sewed together with running stitches about ¼ inch long. The toe was gathered in slightly and fastened to the lower edge of this with a saddler's stitch. Next the tapestry cloth upper was folded, its weft edges being brought together and secured thus from a point (*h*) just below the tab to the lower edge, with a saddler's stitch. A separate thread joined the edges of this cloth from the rim of the quiver to point *h*, at the same time fastening the tab in place by catching it at its center fold. Upper and lower halves of the quiver were joined by tucking 1½ inches of the torn lower edge of the tapestry cloth inside the upper (torn) edge of the plain weave cloth, and sewing them roughly together with two rows of irregular running stitches (*i*). Lastly, the cane rods and carrying strap were added, being placed along the folded edge of the quiver opposite the tab and side seam. Actually only one rod (*g*) was fastened to the quiver when I saw it, and I understand both have since disappeared completely. These rods were nearly as long as the quiver, *g* was about 3/16 inches in diameter and *f* slightly larger. Two holes had been made near the top of rod *g*. A cotton string was knotted through these and one end of it then whipped over the rim selvage of the quiver in a buttonhole stitch (*j*). Six and a half inches down from the quiver's rim a pair of cotton strings was run through the cloth, around rod *g* and out again (*k*). This was repeated 1½ inches below the point where upper and lower halves of the quiver met (*l*). These string loops served to hold the rod close against the inside of the quiver, and to them the upper and lower ends of the carrying strap were knotted. Over-all dimensions of the quiver are: length, 31¾ inches; width at rim, 4½ inches; width at toe, 3 inches. All sewing was done with two- or three-ply cotton thread. (For details of the tapestry weave cloths see pp. 520–522. The fringe of the quiver tab is described on p. 578.)

FIG. 127. Wooden pillow wrapped in cotton cloth. Length, 8¼". Ventana Cave. (Photo by Arizona State Museum.)

The second Hidden House quiver is incomplete (ASM 20492), measuring 13⅜ inches long at the present time. It was made from a single cloth about 7 inches wide, which was folded lengthwise and sewed together along its weft edges. The rounded toe was fashioned in the closed loop technique. A little more than 5 inches of the cloth was woven as a regular plain weave. Then a shift was made to over-three under-three twill, and a design worked out in tapestry with brown, black and white interlocked wefts (see p. 555, figs. 72, 73, 74).

Lastly, there is the article from Mule Creek Cave identified by Cosgrove as a small quiver.[56] It is 10½ inches long, 4¼ inches wide at the rim and 1¾ inches wide at the toe. The bottom is not at present sewed shut. The object was woven to shape on the loom, as a cloth 8½ inches wide at one warp selvage, narrowing gradually to a width of 3½ inches at the other warp selvage. Eight inches of the narrowing was accomplished simply by pulling the warps closer together as each weft was inserted (fig. 126, B). At the wide end of the piece (*a*) there are thirty warps to the inch, while at point *b* there are forty-two or more. Wefts in a 1¼ inches band at the wide end are thicker than wefts in the body of

[55] See Appendix C, chart 22: ASM 20491 and 20492, Hidden House. PM 97397, Mule Creek Cave.

[56] Cosgrove, 1947: 69, fig. 79, *a*. PM 97397.

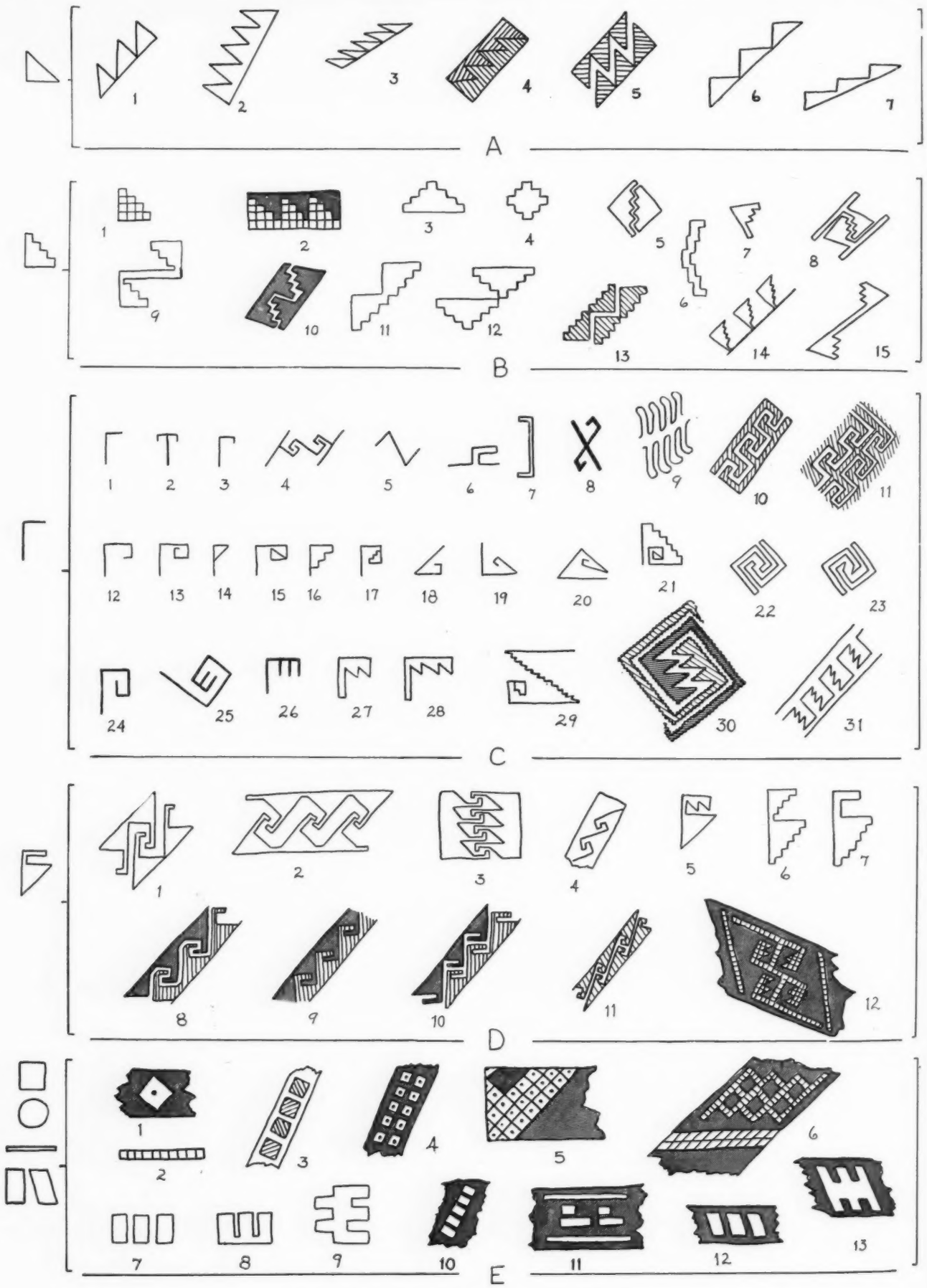


FIG. 128. Elements and Units of Textile Design.

the cloth. At the narrow end warps were used in groups of three and wefts were doubled, the resultant coarse weave forming a 2½ inches wide stiff cuff. Upon removal from the loom the piece was folded lengthwise and the weft edges (which do not contain extra selvage threads) sewed together with cotton thread, reinforced in three places by ties of fine yucca fiber.

6. OTHER USES

We can list a few other uses of cotton. Already described is the braided tump line or sling with rope-like ends from White House (p. 597). The United States National Museum collections from Utah include a heavy round rope, apparently of cotton and very similar in appearance to the sling ends.[57] Cotton string ties for pendants and beads were probably common. The elaborate braid from Tonto (p. 597) and wrapped cords from Kiet Siel and Montezuma Castle (p. 605) were probably ornaments. Cotton nets were perhaps used for snaring small game.

A wooden pillow wrapped with cotton yarn and cotton rags was found under the head of a child in Burial 6, Ventana Cave (fig. 127),[58] and imprints of cloth, presumed to be cotton, appear on the clapper and interior of a clay bell from another Hohokam site.[59] Marks of cloth on Hohokam pottery indicate that pottery paddles were sometimes wrapped with cotton rags. Fewkes uncovered at Honanki a small reed containing a charred wad of cotton, an object which he identified as: "A slow-match to conserve fire after it had been kindled."[60] A pot rest from McEuen Cave (GP 82) consists of a cotton cloth core covered with crushed and split yucca or sotol leaves and bound with a knotted cotton cord (fig. 123, H).

Modern uses of cotton which may have had prehistoric counterparts include the stuffing of shinney balls with cotton at Hano and the employment of cotton seed medicinally at Santa Clara.[61] In the latter case seed obtained from Jemez was used as a remedy for baldness in children. The seeds were crushed and the kernels taken out, chewed, and applied to the child's head. It is possible that cotton-seed oil was used as a food, but there is no record of this. The Papago are said to have used cottonseed flour in making cakes, which were baked on hot sand.[62] Both Pima and Papago parched the cotton seed and ate it like popcorn. These peoples also made tinder from cotton rope.[63]

[57] This piece was on exhibit and not available for analysis when I saw it.

[58] Haury *et al.*, 1950: 423.

[59] Allen, 1953, 16. "A sphere of clay for the clapper was placed within a ball of cotton textile, or, perhaps, another substance covered with cloth, and then wrapped with a few turns of string. Around this the bell was fashioned. Firing consumed the material within, leaving the clapper in place."

[60] Fewkes, 1896: 272.

[61] Robbins *et al.*, 1916: 103.

FIG. 128.

A. The triangle and simple forms derived from it.
B. The terraced triangle, or half terrace, and related forms.
C. The angled hook and its various uses.
D. The triangle and angled hook unit and some of its derivatives.
E. Forms utilizing the square, circle, straight line, rectangle and rhomboid.

VII. NOTES ON TEXTILE DESIGN

INTRODUCTION

The following discussion of textile design is not a complete or profound treatment of the subject, but simply a summary of the most obvious features of pattern construction, with a few remarks on regional design styles and the relationship of prehistoric to modern textile design. Various lines of research which would undoubtedly be rewarding—for example, the comparison of patterns on woven cloth with those on basketry, sandals, matting and pottery—have not been explored at all. The terminology is that established by the design questionnaires of the Clearing House for Southwestern Museums.[1]

METHODS OF PATTERN CONSTRUCTION

ELEMENTS AND UNITS[2]

Basic design elements consist of: the triangle, the half terrace, the hook, the square, rectangle, rhomboid, straight line, and circle. The circle appears only on one painted cloth (the shirt from Poncho House, fig. 113, F) and on some tie-dye material, where it takes the form of a dot at the center of a rounded square or diamond. It cannot be considered an important factor in textile design. The most obvious examples of patterns based on straight lines are the self-patterned twills, in particular Anasazi stripe cloth, warp and weft stripes, checks, and plaids. Gauze, as employed in the Southwest, automatically results in horizontal lines of openwork. It is not with this type of design that we are primarily concerned here. The interest lies more particularly in patterns built up of small geometric units—in other words, with what are often called "tapestry patterns." These are found on cloths woven or decorated by the following means: painting, embroidery, plain and twill tapestries, weft-wrap openwork, twine-plaiting, weft-float pattern weave, brocade and brocaded weft-float or twill. In tapestry patterns the straight line often serves as the base along which geometric elements are placed. The elements of textile design, and various ways of combining them into units, are shown in figure 128.

PATTERNS

Patterns are constructed by combining units and elements in an almost endless variety of ways, which,

[62] Castetter and Underhill, 1935: 37.

[63] Castetter and Bell, 1942: 198.

[1] Douglas, 1941. Raynolds, 1944.

[2] Definitions of the terms *element, unit, design, pattern* and *motif* will be found in the Glossary.

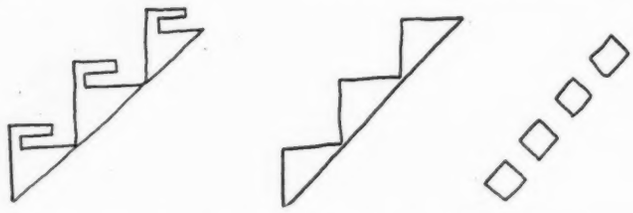


FIG. 129. A series of elements set along an oblique line.

however, follow certain basic conventions. Designs described below under the term "all-over patterns" were laid out so as to cover completely the area to be decorated, whether this was the border of a cloth or its surface as a whole. A second method of designing was to combine the elements into small medallions three to five inches high. These are described under the term "unit designs." The characteristics of tapestry textile pattern construction given below were first mentioned in the section on weft-wrap openwork (p. 505).

All-over Patterns

In constructing designs which were to cover a large area, one common procedure (Method 1) was to arrange a series of elements along a line. This usually slanted across the field oblique to the vertical and horizontal lines of the warp-weft axis (fig. 129). Generally such a line was paralleled by another, along which a second series of the same elements was placed. The two sets of elements were interlocked or opposed between the lines. These parallel rows of elements formed a wide design unit, or band (fig. 130). The broad design bands were, in turn, offset around a rectangular center unit (fig. 131).

Usually the design field was then filled completely with a series of center units connected by the offset bands angling from them. The pattern was not really centered on the field, or planned to fit within its limits. There are no logical margins and such a pattern could be carried to infinity. The feeling is that the weaver envisioned a large design and worked as much of it as possible into the web, simply breaking it off arbitrarily at the edges of the cloth (or that part of it allotted for decoration). Many examples of this type of design will be found in the illustrations (see figs. 20, 29, and 39).

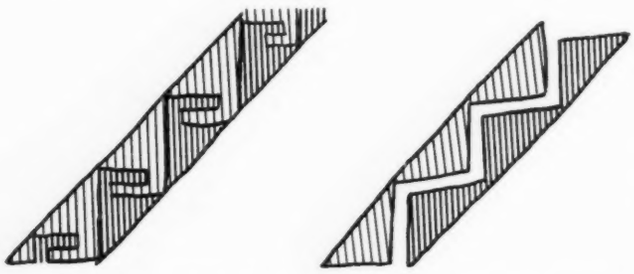


FIG. 130. Interlocked (*left*) or opposed (*right*) sets of elements forming a design unit.

All are from Sinagua, Salado, Eastern Mogollon, or Hohokam sites with the exception of the blanket from Grand Gulch (fig. 64). The kilt from Hidden House (fig. 43) gives the impression of being an abstract version of this type of pattern, with nothing stated except the main obliques. The painted blanket from that site is unique in that, whereas the pattern is constructed in the manner just outlined, structural lines parallel warp and weft, instead of lying oblique to them (fig. 87.)

A second method (Method 2) of laying out an all-over pattern was to place a single rectangular unit at the middle of a cloth so that the four bands angling from it divided the field into offset quarters. Examples are

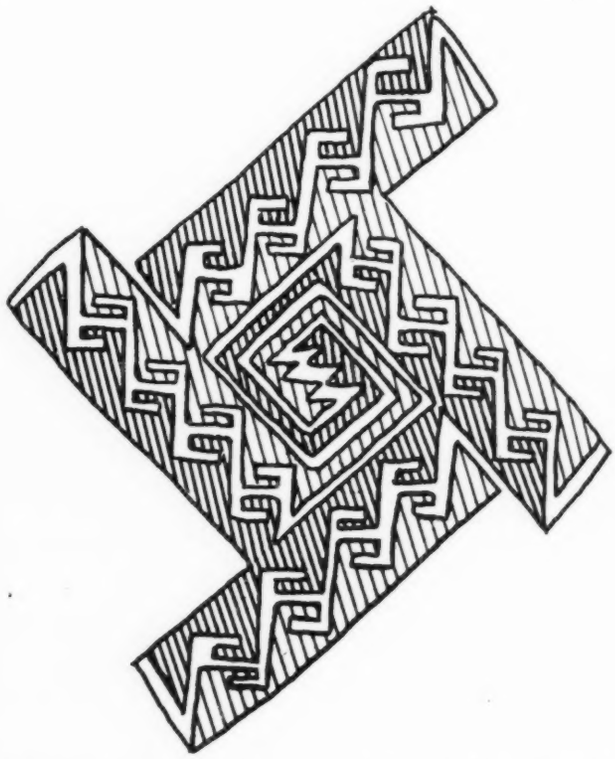


FIG. 131. Design bands offset around a rectangular center unit.

the painted blankets from Painted Cave (fig. 86) and a weft-wrap cloth from Nitsie Canyon (fig. 22, A). In these fabrics the decorative field was actually enclosed within borders, or framed as we would frame a picture. The borders consist of solid bands of color in the case of the painted blankets, and of undecorated plain weave on the weft-wrap cloth. *Warp* borders of this type are three Anasazi pieces. Offset quartering of the design enclosed on all four sides by "margins" except for these three Anasazi pieces. Off-set quartering of the design field, but without borders, may also be seen in the twine-plaited shirt from Tonto (fig. 111).

The breech cloth from White House (fig. 79) shows yet another type of all-over pattern (Method 3), this

one planned to fit as a self-contained unit within the limits of the design field. It consists of a large diamond figure enclosing a tapestry pattern of interlocking double keys. The diamond is centered on the cloth so as to fill it almost entirely (see also fig. 47, B).

It is perhaps reasonable to think of the last two pattern lay-outs (Methods 2 and 3) as simplified versions of the first (Method 1). In Method 1 an unspecified number of center units with angling bands were woven into the cloth. Method 2 utilized but one center unit and its four encircling bands, placing them to fit neatly within the limits of the decorative field. Method 3, presumably applied to small cloths only, made use of the center unit, which was woven so as to fill the design field, leaving no space for offset bands.

Unit Designs

A unit design is a small figure, three to five inches high and complete within itself. While the elements used are the same as those in all-over patterns, their combination into small independent figures isolated from one another by areas of undecorated weave, shows

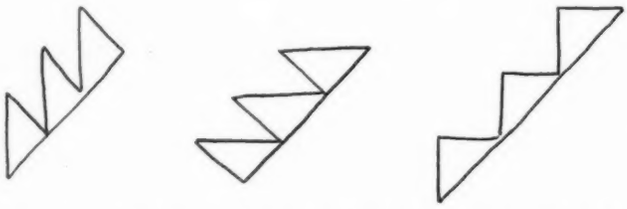


FIG. 132. Positions of triangles with relation to warp and weft. *Left*, hypotenuse parallel to warps; *center*, hypotenuse parallel to wefts; *right*, hypotenuse parallel to main oblique lines of pattern.

a quite different design concept. Medallions might be oriented along the warp borders of a cloth or centered upon it (figs. 24, 25). They are especially prominent in connection with weft-wrap openwork. Examples done in other techniques include a brocaded twill from Grand Gulch (fig. 97, A, 1), a diamond twill tapestry from Tularosa Cave (fig. 62, A, 2) and a bit of embroidery from Tonto Monument. Certain unit designs closely resemble the rectangular center designs of all-over patterns. Compare, for example, the center unit of the brocaded design in figure 139, G with C and D directly above it in the same figure.

VARIETY IN TEXTILE DESIGN

The most striking single fact about tapestry textile design is that, although there are relatively few distinct elements, no two completed patterns are exactly the same. Variety is achieved in two ways. First, and most obvious, is the fact that there are a great many possible combinations of the basic elements. Take, for example, the designs illustrated in the following figures: 22, C; 24, B and D; 29; 42, B, 1; 62, A, 2; and 97, A, 1. The sole or principle element in all of these is a right-angled isosceles triangle. Actually, the only *true* right-angled triangles are those in which the angle comes at the juncture of warp and weft, but most of the other triangles used are so nearly right-angled, and are so obviously intended to represent the same element, that it seems begging the point to put them in a different class. (Very few noticeably scalene triangles appear in textile design.) These are but a few of the varying effects which could be achieved with this single figure.

Secondly, the technique and materials used in the manufacture of a cloth profoundly influence the appearance of the completed pattern. One basic reason for the variation in designs utilizing the isosceles right-angled triangle, for example, is the position in which the triangles are set with relation to the warp and weft (fig. 132). These differences in the placing of triangles are associated with varying weave techniques. Triangles placed with the hypotenuse parallel to the weft are most easily worked in twill, especially diamond twill, wherein two lines of floats—the lower arms of the diamond—angle out from a central point. As might be expected, therefore, this type of triangle is especially prominent in patterns woven in twill tapestry (fig. 138, C, D and I). It is also found in plain weave tapestries, in which case the figure becomes a terrace (fig. 128, B, 12). The placing of triangles so that the hypotenuse forms the main oblique line of the pattern is characteristic of plain weave tapestries and occurs on irregular twill tapestries. It results, in plain weave tapestry, in the "stepped line" (fig. 128, B, 11). Both these forms appear also in weft-wrap (fig. 139, A–E) and embroidery (fig. 138, E, J). Triangles placed with the hypotenuse parallel to the warps are associated primarily with weft-wrap, brocaded plain weave, and twine-plaiting (fig. 139, G, I, K, M).

The relative size of warps and wefts and the spacing of these two sets of threads are factors which help determine the exact size, shape and spacing of elements. A series of triangles set along an oblique line and worked with the same number of warp and weft threads will appear in somewhat differing forms, depending on how closely the wefts are battened. In other words, the angle of the main obliques of the design, a factor which strongly effects its whole character, is determined (in woven patterns) by the ratio of warps to weft per inch. This is demonstrated by figure 133 in which the oblique cuts across the web at an angle of 45 degrees to the horizontal line of the weft if weft threads are not battened closely. The angle is decreased as wefts are battened down so that the number of these threads per inch becomes markedly greater than the number of of warps per inch. Broad triangles and obliques slanted at less than 45 degrees to the weft are especially characteristic of tapestry weaves, with their tight-packed wefts. Cloths in which warps lie close together so that their number is greater than the number of wefts to the inch will tend to be patterned by a design with

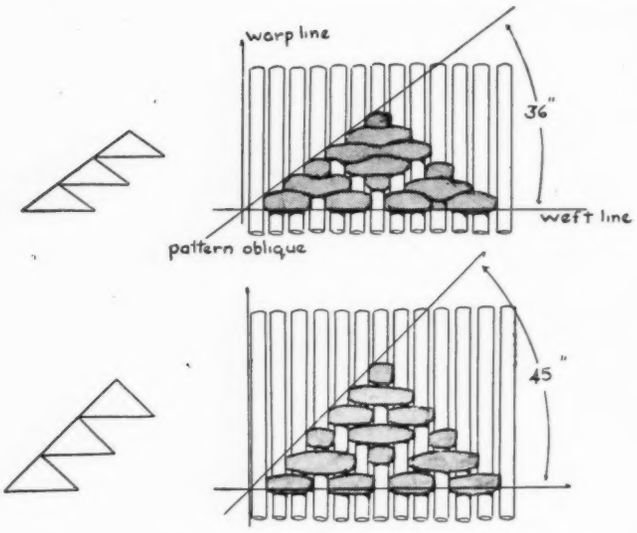


FIG. 133. Effect of the relative size and spacing of warp and weft threads on a design element.

steeply slanted obliques. Such designs are worked in brocaded plain weave or weft-wrap openwork (figs. 21, B; 23; 29; 134).

Figures and lines with terraced obliques are associated primarily with plain weave tapestry (figs. 39–47; 119). They probably originated through the dictates of this technique in pre-loom textiles, such as tump lines, cradle bands, and apron fronts. It is practically impossible in plain weave tapestry with heavy warps to get an unbroken oblique. The wefts must be stepped as they are set over a warp to right or left. This is not the case in *twill* tapestry, wherein wefts automatically form an oblique line as they are inserted (fig. 135). (The uneven *vertical* line produced in twilling is concealed by the closeness with which wefts are battened.) When worked in plain weave tapestry the triangle with its hypothenuse parallel to the pattern oblique becomes a *half terrace* (fig. 128, B, 1); the triangle set with its hypotenuse parallel to the wefts becomes a *terrace* (fig. 128, B, 3); the simple square is a *double terrace* (fig. 128, B, 4); and the oblique line is stepped (fig. 128, B, 11).

The half terrace does appear on certain floated weave tapestries, but in these it must be set at an angle to the warp-weft axis (fig. 136). The resultant designs are quite different from those usually worked in plain tapestry with the same element (fig. 137, H–J, L).

REGIONAL STYLES

In spite of the limited amount of material with which we must work, certain distinctions can be made between Anasazi Pueblo III textile design and that of Pueblo III and IV groups to the south. It is not possible, on the basis of the material at hand, to establish convincing differences between the textile patterns of the Sinagua, Salado, Eastern Mogollon, and Hohokam. The Jeddito murals furnish a guide to design in the Pueblo IV Hopi towns and many prehistoric motifs may be recognized in modern Pueblo embroidery and brocade, though in somewhat modified forms.

THE CHARACTERISTICS AND BACKGROUND OF PUEBLO III ANASAZI TEXTILE DESIGN

Self-patterned Twills

Anasazi stripe twills are a class of patterned textiles peculiar, so far as we know, to the northern Pueblo peoples (fig. 81). The opinion has already been expressed that these originated through the conscious copying in loom-woven cloth of striped designs on Basketmaker flexible twined-woven bags (pp. 563–565).

Tapestry Patterns

The most common elements of Anasazi tapestry pattern are: the terraced triangle or half terrace; the whole terrace; terraced lines; the square; the square with center dot; the right-angled parallelogram, or rectangle; and the oblique-angled parallelogram, or rhomboid (fig. 128, B and E).

Various triangle and angled hook elements, found only on *painted* cloth, are not really typical of Anasazi textile design as a whole (see below, p. 631). The relationship of terraced figures to the plain weave tapestry technique has been demonstrated. In my opinion this technique, as a pre-loom finger process, must be considered the ultimate source of terraced motifs among the Pueblo peoples. Rows of rectangles and rectangles offset along a center band (fig. 128, E, 7, 8 and 9) are characteristic of plain weave tapestry (fig. 46) and plain weave warp-face belting (fig. 53, A, B). These techniques may be the source of this simple element. The rhomboid may have evolved from the rectangle. Both rectangle and rhomboid often appear as elements in negative design, strongly suggesting the influence of the tie-dye technique. The square and square with center dot almost certainly originated in tie-dye.

Plain and Twill Weave Tapestries

The importance of terraced elements, in particular the half terrace, is clearly illustrated by the small

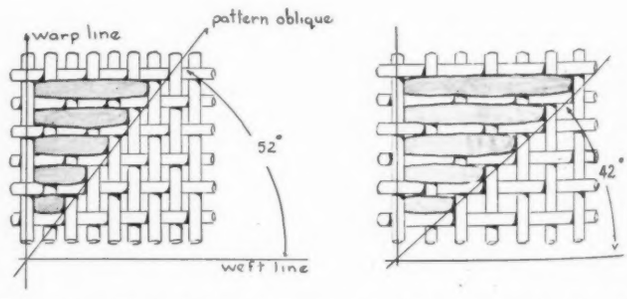


FIG. 134. The relation of the pattern oblique to the spacing of warp and weft threads. *Left*, closely spaced warps and steep obliques; *right*, warps spaced well apart and oblique gradual.

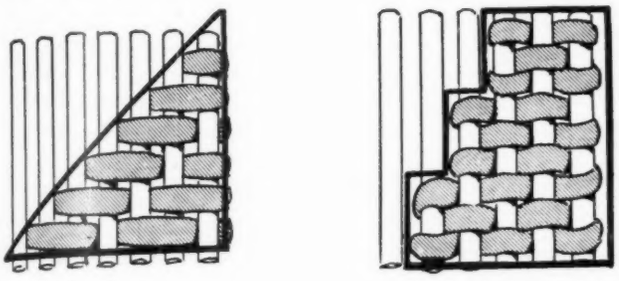


FIG. 135. The correlation of the terraced line and plain tapestry weave. *Left*, triangle worked in irregular twill; *right*, terraced triangle, or half terrace worked in plain weave tapestry.

sketches of Anasazi plain and twill tapestries in figure 137, C–E, H–J, L, M. Not infrequently it is used to create patterns of interlocking black or brown keys separated by narrow white lines. The effect closely resembles the negative line designs of modern Pueblo embroidery, and may, indeed, be the source of this trait.

Rectangles and rhomboids are used in tapestries as small white figures against brown or black backgrounds (fig. 137, H).

Tie-dye

Tie-dye designs are built from a series of units, each consisting of a square or diamond with rounded corners enclosing a small dot. These units are arranged in rows which usually lie oblique to the warp-weft axis and form sprawling geometric patterns on the dark ground. Sometimes half terraces are featured in these patterns. Since most examples are fragmentary we cannot tell how common this motif was in connection with tie-dye. The kilt illustrated in figure 140, G is an example of it in Pueblo IV.

Painting

Many of the elements of painted design appear to have evolved from tie-dye patterns. This includes the grid with center dots, small squares set in a row and the segmented bar or band (fig. 128, E, 2, 3, 5, and 6). In fact, the whole practice of negative painting and, by extension, the concept of negative design as carried out in other weave techniques, may well have its roots in tie-dye.

Painted patterns utilize not only tie-dye elements, but also those found on tapestry weave cloth. The fragment of painted cloth illustrated in figure 137, G, for example, shows a negative design of interlocking half terraces created by a clever arrangement of narrow bands and rhomboids. Certain elements of the line designs on cloths from Painted Cave obviously derive from the half terrace and terraced lines (fig. 137, K; 128, C, 21 and 29).

In addition to these design forms a number of elements, unusual or entirely lacking on Anasazi woven material, appear on painted cloth. These are: the triangle with angled hook, the triangle with sawtooth hook, the angled hook combined with half terrace, the angled hook combined with a triangle and the triangular scroll (fig. 128, C, 12–21, 24, 27, 29; D, 11 and 12). Many of them are used on Anasazi Pueblo III painted *pottery*. Hence, they were not unfamiliar to the people. Not selected for use on loom-woven tapestries, they were reserved for painted textiles, wherein the artist was not hampered in the execution of a complex design by the limitations of a weave technique. A number of these elements are characteristic of woven textile patterns from central and southern Arizona.

Weft-wrap Openwork and Brocade

Two weft-wrap cloths, one from Northern Arizona (fig. 27) and the other thought to have come either from Canyon de Chelly or the Kayenta area (fig. 22, D and E), do not fit into the picture of Anasazi Pueblo III woven textile design as we have drawn it. They are patterned by triangles with angled hooks, a common motif on Sinagua-Salado plain and twill tapestry cloth (fig. 138, B, H, K, L) and by triangles of the type associated with brocade and weft-wrap in the south (fig. 139, G, I, K, M). Since neither the technique nor the design of these cloths is characteristic of Anasazi work, it is likely that we are dealing with trade material. There is every possibility that painted cloth from the Kayenta area was exchanged for openwork material from the Upper Verde Valley.

A third weft-wrap, from Nitsie Canyon, is designed in typical Anasazi fashion and may have been woven locally (figs. 22, A; 137, F). The half terrace (set with its hypotenuse parallel to the wefts—a position it would not take in plain or twill tapestry) appears in the center unit of the pattern, which is laid out so as to quarter the design field. There are borders of plain weave at all four selvages.

The figure worked in brocaded weft-float or twill at the center of a twill cloth from Grand Gulch (fig. 97, A) is reminiscent of southern, rather than Anasazi, work. Unit designs, triangles set along the outside of oblique lines and the brocade technique are all Mogollon-Pueblo and Hohokam characteristics (fig. 139).

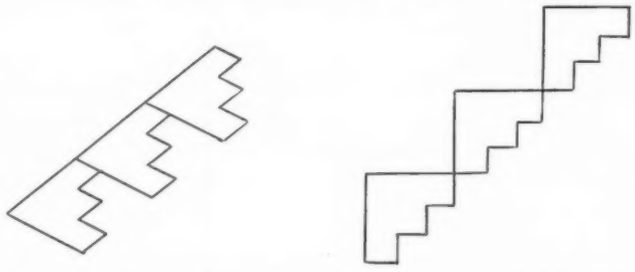


FIG. 136. A comparison between half terraces worked in plain and twill tapestry weaves. *Left*, a diagonal row of half terraces woven in irregular or diamond twill tapestry. *Right*, a diagonal row of half terraces woven in plain weave tapestry.

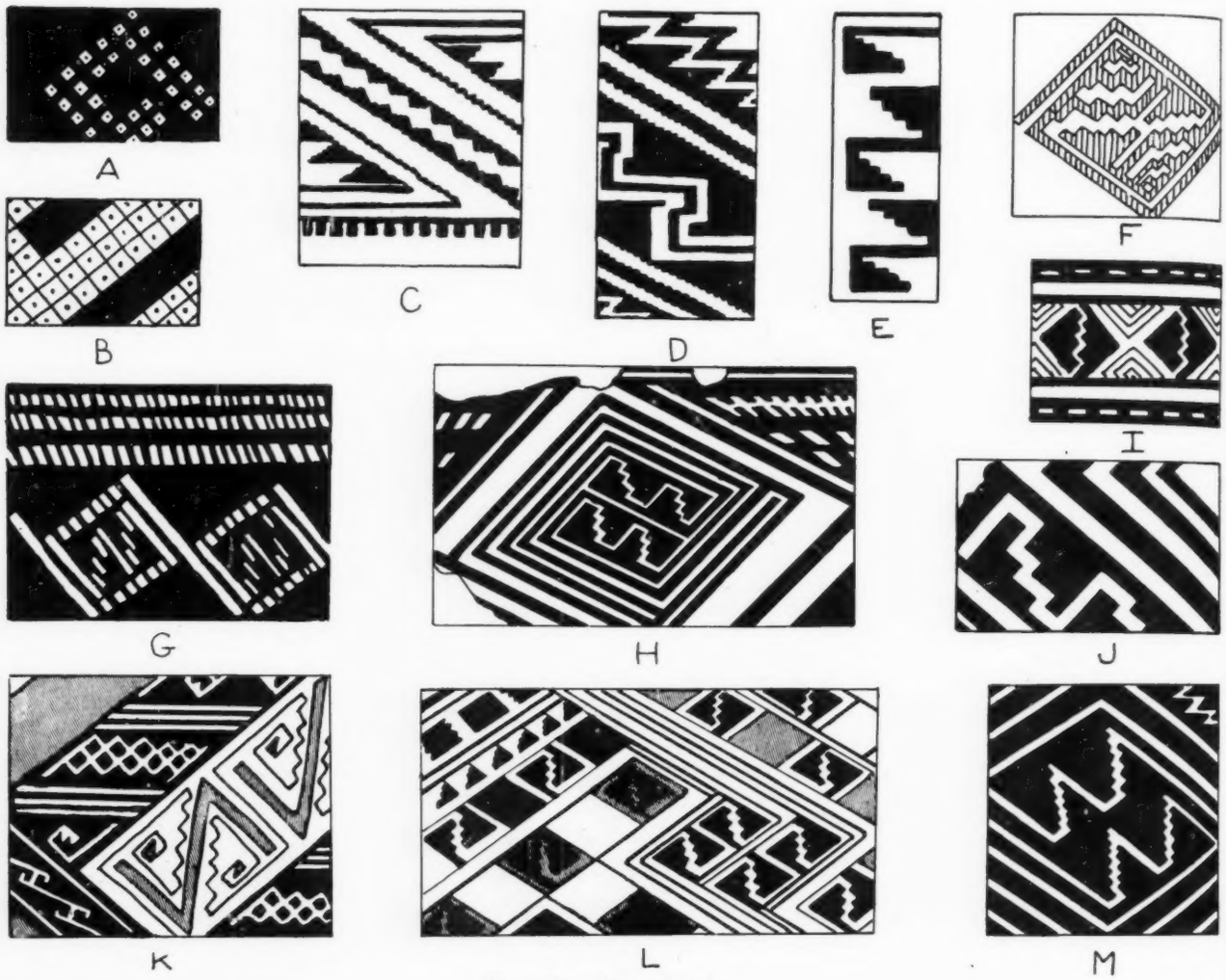


FIG. 137. Anasazi design.

A. Tie-dye pattern on a fragment from White House. (AMNH 29.1/7541a.)
B. Painted fragment doubtfully assigned to the Kayenta area. (AMNH no number.)
C. Design on a plain weave tapestry cradle band from Nitsie Canyon. (ASM 2775.)
D. Plain weave tapestry skirt band. Kiet Siel. (MNA 695/NA2519.759.)
E. Plain weave tapestry skirt band from northern Arizona. (ASM 25982.)
F. The center design unit of a weft-wrap openwork cloth from Cave Town Ruin, Nitsie Canyon. (ASM 2151.)
G. Painted cloth from White House. (BM 03.251.)
H. Plain weave tapestry cloth with brocaded weft-float center design from White House. (BM 03.250–6.)
I. Twill weave tapestry fragment. Mesa Verde. (Nordenskiöld, 1893, pl. L.)
J. Diamond twill tapestry. Northern Arizona. (MNA 1233/A1481.)
K. Painted blanket from Painted Cave. (Haury, 1945*b*: pl. XI.)
L. Diamond twill tapestry blanket fragment. Grand Gulch. (AMNH H/15982.)
M. Plain weave tapestry band. Northern Arizona. (PM 3196.) (The half terraces take the position usually associated with floated weave patterns.)

Offset quartering of the design field and the actual delimitation of the field by four margins has so far been found only on Anasazi Pueblo III cloths.

THE CHARACTERISTICS AND BACKGROUND OF PUEBLO III AND IV, SINAGUA, SALADO, EASTERN MOGOLLON AND HOHOKAM TEXTILE DESIGN

Plaids and Checks

Plain weave blankets with check or plaid patterns were probably woven for everyday use, taking the place of the Anasazi stripe twill cloth of northern Pueblo peoples.

Tapestry Patterns

Textile patterns from central and southern Arizona and southwestern New Mexico employ a wider variety of elements and are generally more complex in character than those from Anasazi sites (with the exception of painted cloth from the latter). The most important elements are: the hook, the triangle, and a combination

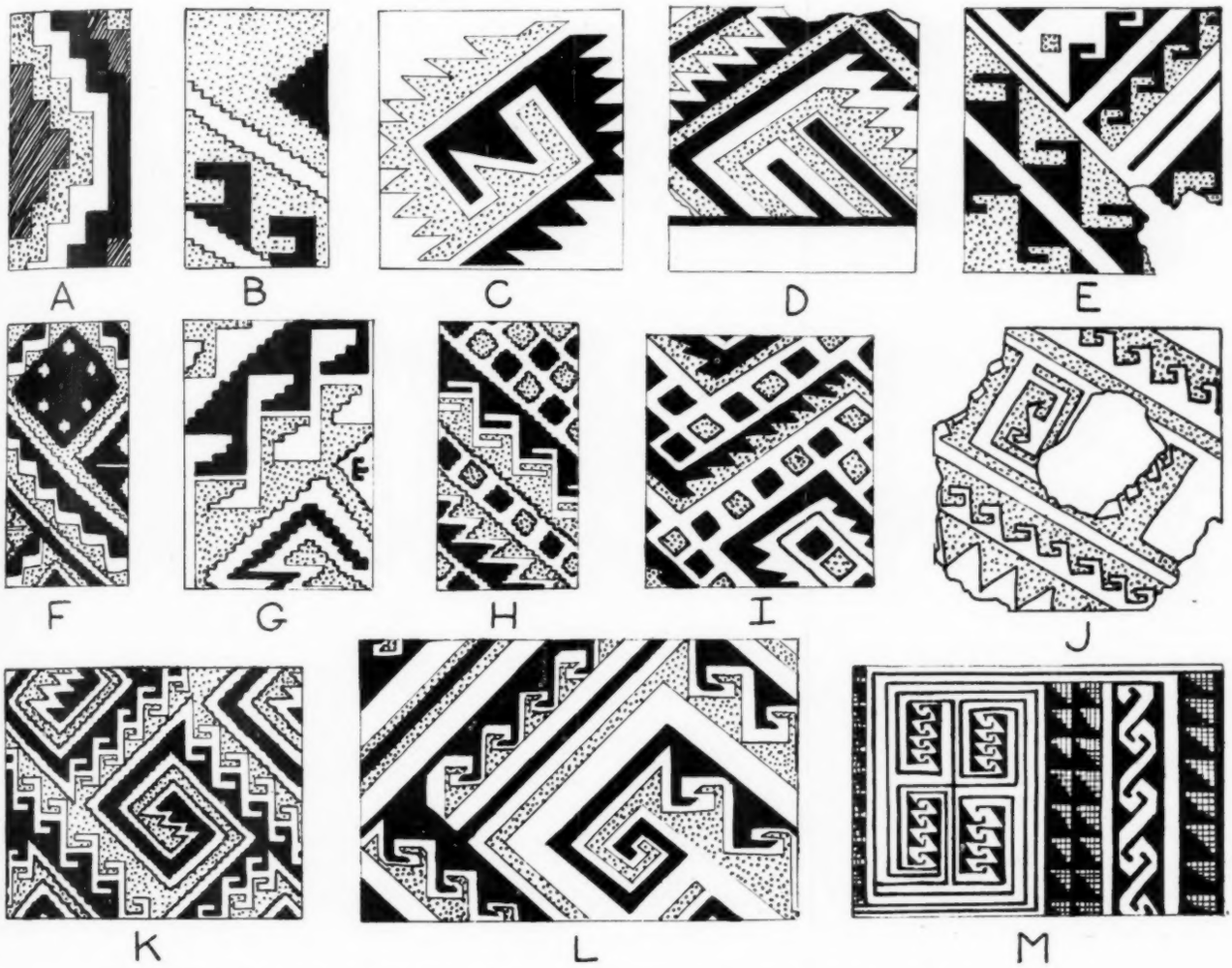


FIG. 138. Plain and twill tapestry and embroidery patterns. Sinagua, Salado, and Eastern Mogollon.

A. Slit tapestry tie. Montezuma Castle. (AMNH 14/224.)
B. Plain weave tapestry tump line. Tonto. (NPS–T no number.)
C. Diamond twill tapestry. Tularosa Cave. (Martin *et al.*, 1952: 299–300.)
D. Twill tapestry. Wupatki. (MNA 77/NA405.M233.)
E. Embroidered cloth. Walnut Canyon. (MNA 696/NA746.1.)
F. Plain weave tapestry tump line. Palatki. (USNM 156276.)
G. Plain weave tapestry tump line. Wupatki. (MNA 77/NA405.M234.)
H. Plain weave tapestry tab on a quiver from Hidden House. (ASM 20491.)
I. Twill tapestry. Tonto. (NPS–T 9/483.)
J. Embroidered cloth. Tonto. (NPS–T 9/713.)
K. Plain weave tapestry quiver. Hidden House. (ASM 20491.)
L. Twill tapestry. Hidden House. (ASM 20492.)
M. Painted blanket, possibly a trade piece from the Kayenta area. Hidden House. (ASM 20511.)

of these called the "triangle with angled hook" (fig. 128, A, C and D). The unterraced triangle set with its hypotenuse parallel to the warps or wefts is a distinctive feature of southern design (fig. 128, A, 1–5). Certain other elements—some terraced figures and the "tie-dye square"—are the same as in Anasazi-Pueblo work. The half terrace, set with its stepped edge parallel to the warps and used as a distinct element in various key-like patterns, is not characteristic of material from any group outside the Anasazi area, however.

Plain Weave Tapestries (Sinagua, Salado)

The triangle with angled hook, when worked in plain weave tapestry, automatically becomes a half terrace with angled hook (fig. 128, D, 7). This is a very common element in plain tapestry design. Others are: the half terrace set with the hypotenuse oblique to the warp-weft axis, terraced lines, the whole and double terrace, and a simple cross (fig. 128, B, 3, 4, 6, 11, and 12). The double terrace and cross may have evolved from

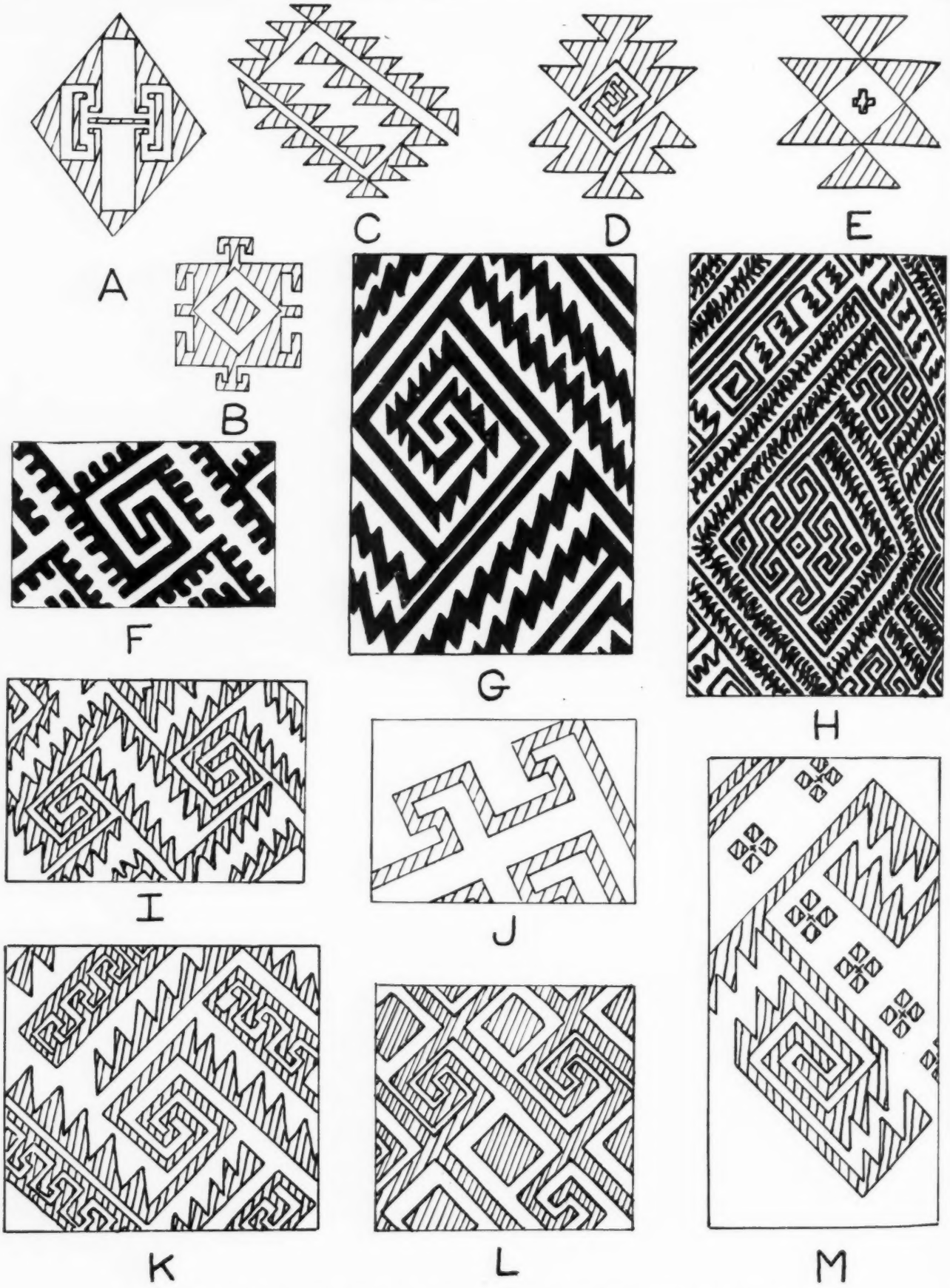


FIG. 139. Patterns in weft-wrap openwork, brocade, weft-float and twine-plaiting. Sinagua, Salado, Eastern Mogollon and Hohokam.

tie-dye squares—the sides being stepped as the result of the technique. Interlocked sawtooth hooks are found on one plain weave tapestry cloth (figs. 39; 40; 128, C, 30; 138, K).

Twill Tapestries (Sinagua, Salado, and Eastern Mogollon)

Important elements of twill tapestry design are: the triangle with angled hook, the simple square, interlocked angled hooks and triangles set with the hypotenuse parallel to the weft (fig. 128, A, 2, 3 and 4; C, 22; D, 1, 7–10; E, 3). The last-named is especially typical of twill tapestry design as we know it (fig. 138, C, D and I).

Embroidery (Sinagua, Salado)

Unfortunately we have but three good prehistoric examples of true embroidery. The design on the piece from Walnut Canyon (fig. 138, E) is simply a copy of a Sinagua-Salado tapestry weave pattern. The fragments from Tonto, while they also utilize elements of woven design, show certain irregularities of line which would not occur in loom weaving (fig. 138, J). Embroidery, like painting, is a method of applying design to a completed fabric. The artist need not be controlled by weave technicalities. Although the embroidery stitches used prehistorically did not allow complete flexibility in building a pattern, they did permit some departure from the rigid demands of a loom weave.

Painting (Sinagua)

The only good example of painted cloth from outside the Anasazi area is the blanket from Hidden House (fig. 87). It has already been suggested (p. 572) that this may have been imported from the Kayenta area, since its pattern closely resembles the type found on black-on-white Pueblo III pottery from that region. The design on this and the Painted Cave blankets illustrates how, in painting even more than in embroidery, the artist could break away from technical controls and arrange the elements of his pattern in any position he wished.

Weft-wrap Openwork, Twine-plaiting, Weft-float Pattern Weave and Brocade (Sinagua, Salado, Eastern Mogollon, Hohokam)

Another kind of pattern, utilizing principally the triangle and the hook, but somewhat different in character from that associated with tapestry weaves, may have developed originally in any of the four techniques with which we find it associated in Pueblo III and IV (fig. 139). The main obliques are apt to be steeply slanted, a fact correlating with closely packed warps (pp. 629–630) and *not* characteristic of patterns worked in plain or twill tapestry with their closely battened wefts. Triangles are set with the hypotenuse paralleling the vertical line of the warp. Angled hooks are used in several ways. They may appear in center design units, interlocked to make a rectangular scroll. Rows of opposed hooks are used to create a classic meander design. Hooks are also set on the opposite sides of an oblique line (fig. 128, C, 8–11, 22, 23). In the Montezuma Castle weft-floats angled hooks form a complicated center design unit (figs. 77; 78; 139, H).

Weft-wrap is a flexible technique—a kind of embroidery on the loom. The holes from which the design is built may be set in any desired sequence, and any type of pattern can be copied. Designs of the type associated with tapestry weave cloth are found in weft-wrap, as well as patterns of the type just described. There is even one weft-wrap in which the half terrace, familiar to us as an Anasazi element, appears (fig. 137, F). Most of the unit figures on record are worked in this technique (fig. 139, A–E).

FIG. 139.

A. Unit design in weft-wrap openwork. Graham County. (USNM 363987–8.)
B. Unit design in weft-wrap openwork on a child's poncho from Ventana Cave. (ASM VC #22.)
C. Weft-wrap openwork design. Canyon Creek. (Haury, 1934: 93, fig. 19.)
D. Weft-wrap openwork unit figure. Casa Grande. (Hough, 1914: fig. 163.)
E. Unit design in weft-wrap openwork. Bear Creek Cave. (USNM 246123c.)
F. Brocaded bag. Verde Valley. (AMNH 14/228.)
G. Brocaded cloth. Clear Creek, Verde Valley. (AMNH 29.1/5508.)
H. Weft-float pattern weave bag. Montezuma Castle. (NPS–MC 18.)
I. Weft-wrap openwork design. Ventana Cave. (ASM VC B #34.)
J. Pattern on a fragment of weft-wrap openwork. Montezuma Castle. (NPS–MC 34.)
K. Twine-plaited shirt. Tonto. (ASM 13400.)
L. Weft-wrap openwork pattern. Mule Creek Cave. (PM 34–12–10/2738.)
M. Design on a weft-wrap openwork fragment from Ventana Cave. (ASM VC B #9.)

TEXTILE DESIGN IN THE HOPI COUNTRY, PUEBLO IV

Weaving in the Hopi country between 1300 and 1550, as depicted in the Jeddito murals, was a blend of Anasazi Pueblo III and southern Pueblo and Hohokam *techniques*. The textile *designs* shown on kilt borders are, however, almost entirely southern in character. It is probable that the technique represented is embroidery, itself thought to be an importation into northern Arizona after 1300. We have spoken more than once of the fact that this decorative process, rare in collections of prehistoric textiles, apparently replaced fancy loom weaves between 1300 and 1550 to become the most important medium of tapestry design in historic times. While early embroideries (for example the Walnut Canyon piece, fig. 36) simply copied familiar woven patterns, the relative freedom permitted by the needle process gradually fostered the development of new elements and new ways of combining or placing the old, conventional ones.

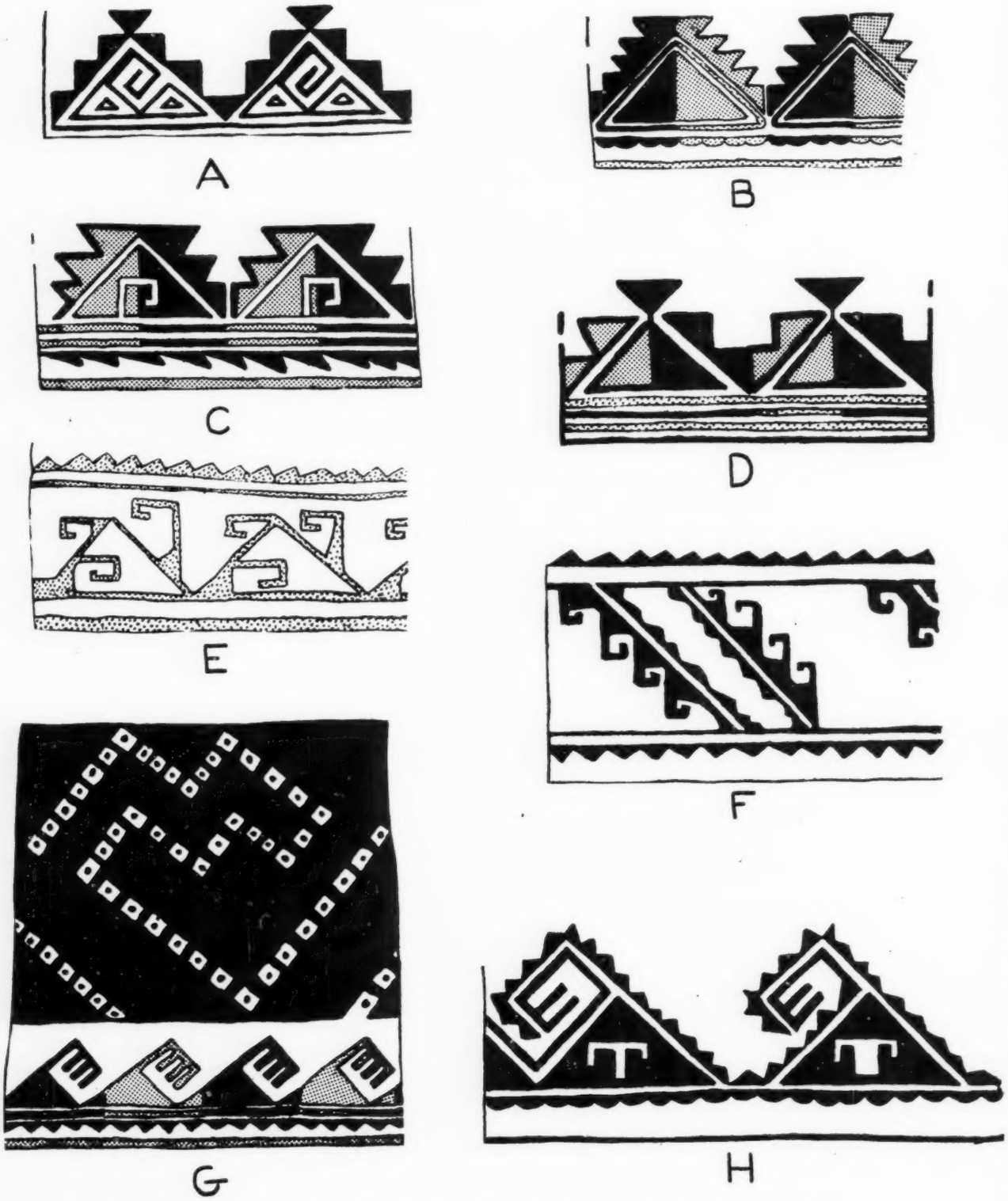


FIG. 140. Designs on kilts in the Jeddito murals. (These drawings are taken from Smith, 1952*b*: fig. 25, with the exception of G, which is a copy of the kilt reproduced in Mera, 1943: pl. IV.)

Representative patterns from the murals are shown in figure 140.[3] The only Anasazi characteristics are tie-dye design (G) and the presence of narrow white lines cutting through areas of solid color (B–D, F–H). Southern elements include the triangle with angled hook and the triangle set with hypotenuse parallel to the wefts. The triangle with angled hook, however, is often placed at angles to the warp-weft axis which it never took in prehistoric woven cloth, but only on painted material. The hook has become more involved. Either it is bent once or twice more upon itself or a row of "teeth" has been added to it (G). Some designs (A–D) utilize terraced triangular figures which appear to be the upper half of the unit patterns found in weft-wrap (fig. 139, A–E) and on the brocaded twill from Grand Gulch (fig. 97, A). A feature important in modern Pueblo embroidery design, but not found prehistorically elsewhere than in the Jeddito murals, is the dividing of the pattern horizontally into bands of varying width, and the breaking of these bands into vertical color zones (B–D, G).

MODERN PUEBLO TEXTILE DESIGN

Modern Pueblo embroidery patterns are obviously a blend of prehistoric motifs from all over the Southwest, with the addition of basically only one European element. Design elements and patterns are decidedly more complex than in prehistoric material. Traits evolved from Anasazi design are fully as important as those having their roots in the work of groups from the south—a fact not true, as we have seen, of the Jeddito "embroideries."

Figure 141 illustrates a few historic patterns. The prehistoric sources from which the component parts of these patterns may have evolved are as follows:

A. Both the fact that it is a small medallion, and the triangle with angled hook unit from which it is built, relate this design to Sinagua, Salado and Hohokam material. It should be compared with the weft-wrap designs in figure 139, A, B.

B. From the same ultimate prehistoric sources as *A*, this figure is almost identical with a weft-wrap from Bear Creek Cave (fig. 139, E).

C. The various parts of this pattern relate to prehistoric unit figures, marking it as essentially the outgrowth of Pueblo III–IV Mogollon-Pueblo and Hohokam design. The terraced triangle (*a*) at the upper edge of the design band may be thought of as half of a unit pattern. The same is true of (*c*). The center unit design (*b*) is very similar to that shown in figure 139, B.

D. Acoma "bird" patterns (1) must be recognized as modern versions of Mogollon-Pueblo and Hohokam unit figures such as C, D, and E in figure 139. The "wings" (*a*) resemble a motif found on one Jeddito kilt border (Smith, 1952*b*, fig. 25, *i*). The center design (*c*) of the "bird" illustrated here is made up of opposed half terraces separated by a narrow white line —a typically Anasazi Pueblo III motif, though the half terraces are markedly elongated in comparison with their prehistoric form (fig. 137, H, J, L). The upper border (2) is patterned by another modified half terrace motif (*a*), as well as by a row of triangles with angled hooks (*c*), which brings to mind especially Sinagua-Salado tapestry design. The lower border (3) combines the upper half of a Mogollon-Pueblo-Hohokam type unit figure (*a*) with modified Anasazi half terraces (*c*, *d*). In all three designs the presence of vertical color zones, first noted in the Jeddito murals, may be observed (*b*). Also there is the use of negative lines to break up areas of solid color, an idea best expressed, prehistorically, in Anasazi textiles (fig. 137, H, J, M).

E. Prehistoric elements from all parts of the Southwest are combined in this design. The row of triangles with angled hooks along the top of the band (*a*) and the series of these units placed along an oblique line in the body of the pattern (*d*) relate to Sinagua-Salado plain and twill tapestry design. The slanting row of squares (*c*) brings to mind both Anasazi- and Mogollon-Pueblo patterns (fig. 137, A, B, G, K and fig. 138, H, I). So also does the terraced line (*b*), or series of triangles set with their obliques parallel to the warp-weft axis. The design is also marked by the presence of negative lines cutting through the solid color areas (*e*) and by vertical color zones.

F. This pattern is included because it employs the terrace (*a*), an element which may have evolved from prehistoric Anasazi- and Mogollon-Pueblo plain tapestry weave textile design (fig. 137, C, D and fig. 138, A), and ultimately from pre-cotton Basketmaker tapestries (p. 630).

CONCLUSIONS

It is probable that the first design elements woven into cotton cloth were copied from pre-loom, pre-cotton textiles. Among Anasazi- and Mogollon-Pueblo peoples alike these apparently consisted primarily of various terraced figures—essentially the triangle and the oblique line—which had been developed in non-loom plain weave tapestry. The patterning of cloth by tie-dye must have been introduced at the very beginning of the Pueblo venture into loom weaving, bringing with it simple square and rectangle elements and the idea of negative design. Designs based on elements taken from non-loom tapestries and tie-dye were probably typical of Pueblo textiles as a whole between 700 and 1000 or 1100. They were carried out primarily in plain and twill tapestry, tie-dye and painting. The same type of design and the same techniques were still dominant among the Anasazi until 1300. Added to them in the Mogollon-Pueblo region, between about 1000 and 1450 were motifs introduced by the Hohokam and asso-

[3] These are taken from Smith, 1952*b*, fig. 25 and Mera, 1943: pl. IV.

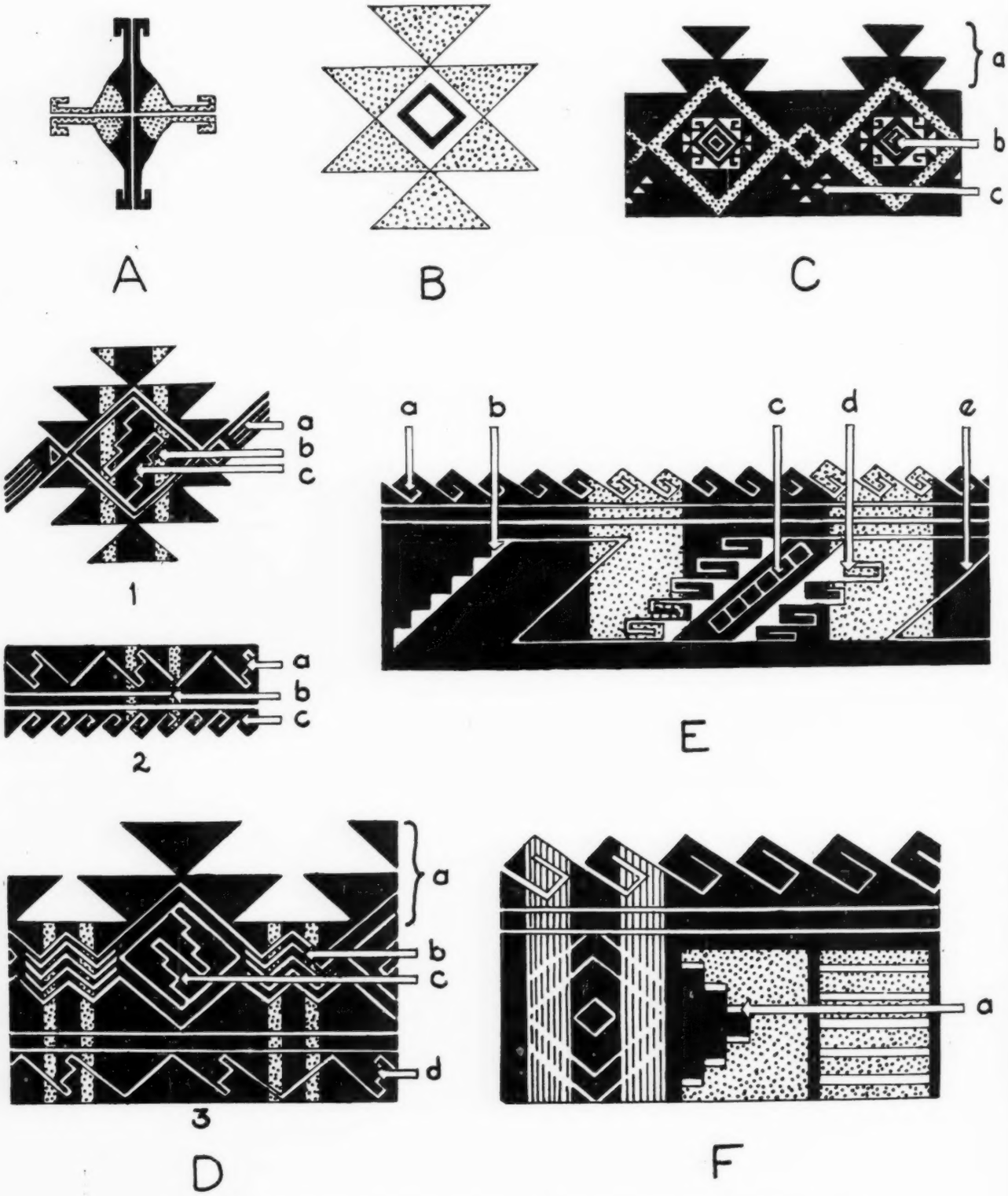


FIG. 141. Modern Pueblo embroidery patterns. (These designs are taken from Mera, 1943.)

ciated with non-Pueblo techniques—weft-wrap, brocade, and weft-float pattern weave. Hohokam influences may have arrived in two waves—the first responsible for the introduction of weft-wrap openwork and the triangle and angled hook unit which became so basic a form in Sinagua-Salado design; and the second bringing brocade, weft-float, and patterns distinguished by steeply pitched obliques and the triangle with hypotenuse parallel to the warps. Steep obliques correlate with closely-packed warps (pp. 629–630). Their presence in southern design may simply indicate that textiles there were being woven of more finely-spun thread than in the Anasazi-Pueblo area. The embroidery technique gradually replaced loom processes in Pueblo IV, first in southern Arizona and, towards the end of the period, in the Pueblo area.

Southern design elements were used on painted cloth by the Anasazi between 1100 and 1300, but did not become important in northern Pueblo textile design until Pueblo IV, when they were carried, along with the embroidery technique, to the Hopi country, Zuni and the Rio Grande Pueblos by immigrant groups from central and southern Arizona.

VIII. REGIONAL DEVELOPMENTS IN WEAVING FROM THE TIME OF CHRIST TO THE PRESENT

PREHISTORIC, ?B.C.–1550

Weaving was subject to the same impulses that gave rise to local specializations in pottery, architecture, and other cultural manifestations. One would expect, therefore, to find regional and period variations in weave techniques, tools, and types of woven cloth. In spite of the extremely limited number of specimens which have survived of the thousands that must have been woven, a few rather broad differences do appear in the craft during the 550 years for which we have the best information, approximately 1000 to 1550. If we had truly representative collections from earlier periods and from all parts of the area the textile arts would probably show at least as much variation as that recorded for ceramics.

Differences are most marked between the weaving of the Pueblo III Anasazi (1100–1300) and that which we know or assume to be typically Hohokam at the same time and in the succeeding period. Weaving in southern Arizona appears to have been subject to a series of influences from central and southern Mexico via the west coast of Mexico after 1100 which reached only as far as the Upper Verde and Middle Salt Valleys by the end of Pueblo III but did not affect the textile arts of the Anasazi to any extent before 1300. This accounts for some of the basic differences. Others may reflect distinctions that existed between the bast fiber textiles of Pueblo and Hohokam peoples before the introduction of the loom. It is probable, too, that different techniques were selected for elaboration by each group and new processes invented by both. Possibly some of the early influences on Anasazi weaving reached them via the Mogollon from Chihuahua, while the Hohokam received theirs from the west coast of Mexico. In addition to Anasazi and Hohokam developments we seem able, though with less assurance, to recognize a number of traits which may be thought of as Mogollon-Pueblo specialties.

The following discussion of regional developments in weaving is based only on those techniques, tools, or articles for which we have adequate information.

ANASAZI WEAVING, 300–1300

The greatest number of fabrics analyzed come from Anasazi sites and the picture they present of cotton weaving in the San Juan between 1100 and 1300 is probably quite complete. The antecedents of loom weaving in cotton can be traced in this area to at least 300 through Basketmaker material (see table 6 and p. 642). Anasazi weaving between 300 and 700 was based on the use of bast fibers, human and animal hair. So far there have been no well-authenticated finds of cotton prior to 700, although there are suggestions that it may have been present to some extent two or three centuries before that date. Basketmaker techniques do not relate to loom processes with the possible exception of plain weave apocynum cloths from the Kayenta area (Appendix A). These are of peculiar interest since they resemble fiber cloth from Northwest Chihuahua which is thought to be pre-pottery, and possibly loom-woven. Perhaps we should credit the Anasazi with knowledge of the loom around 300–400. However, even if they did have it, it was apparently not until 700 that cotton was available in sufficient quantity for loom weaving. The earliest well-documented find of cotton comes from a Pueblo I burial in the Tsegi, which yielded not only plain weave white and checked cloth, but also a plain weave tapestry tump line of cotton and hair.

Cotton material considered to date between 900 and 1100 is in all respects similar to Pueblo III textiles. Loom-woven bast fiber cloth is, however, reported from Floating House and Chaco Canyon. This is not characteristic of Pueblo III Anasazi collections, so far as I know. Although it may have been present, there is no evidence of the wide vertical loom in Anasazi territory

FIG. 141.

A. Unit figure on a cotton shirt from Jemez. (Pl. XIII, p. 47.)
B. Small figure from the embroidered border of a woolen manta. (Pl. XVII, p. 55.)
C. Section of an embroidered band on a woolen manta. (Pl. XXIII, p. 67.)
D. Patterns from an embroidered cotton manta. Acoma. (1) One of two "bird" figures centered on the manta just below the top border. (2) A section of the border design at the top of the cloth. (3) A section of the border design at the lower edge of the manta. (Pl. VI, p. 33.)
E. Portion of the border of a cotton kilt. (Pl. XI, p. 43.)
F. Portion of the border of a cotton kilt. (Pl. XI, p. 43.)

before 1100 except for the fact that plain weave cloth is weft-face. The belt loom was almost certainly in use in the Chaco by 1000 and may also have been known in other districts.

The abundance of material from Pueblo III sites is proof that by 1100 cotton had become the basic fiber for loom-woven cloth and had replaced bast and wool in many non-loom fabrics. It was being grown locally, so that an adequate supply of fiber was assured. A complex of tools, techniques, and articles that may be considered characteristic of Anasazi Pueblo III weaving had spread throughout the San Juan. The essential components of this are:

Tools:

Disk whorl spindle.
Wide, vertical loom usually set up in the kiva.
Some use of the belt loom.

TABLE 6

EVIDENCES OF COTTON AND LOOM WEAVING IN THE ANASAZI-PUEBLO AREA, 300–1300

Approx. Dates	Evidences of Cotton and Loom Weaving	Sources of Evidence[1]
1300	Seeds, plant parts, fiber	Aztec (Mesa Verde Annex)
		Bat Woman House
	Tools:	Betatakin
	Anchor holes for vertical loom, generally in kivas	Black Creek
	Anchor holes for belt loom (Mesa Verde only)	Canyon de Chelly
	Battens, large and small, wood	Canyon del Muerto
	Ginning "switches"	Cave Town Ruin
	Loom end sticks, probably for belt looms	Cedar House
	Spindle whorls of wood, slate, horn, squash rind, and possibly pot sherd.	Chilchintaboko
	Disk-shaped. (Some tubular and rectangular whorls in Tsegi and Nitsie Canyons.)	Deer Track Canyon
		Eagle's Nest
	Tenter	Forbidden Canyon
	Weaving combs, wood	Ford House Ruin
	Yucca leaf tip needles	Gold Tooth Canyon
		Gourd Cave
	Techniques:	Grand Canyon
(P III)	*Loom weaves.*	Grand Gulch
	Embroidery, twine- and running-stitch. (Some of the latter may be brocade.)	Hagoe, Cliff Houses #5 & #6
		Hospitibito Canyon
	Gauze (?)	Kayenta area
	Plain weave, weft-face	Kiet Siel
	Heavy decorative wefts	Kinboko Canyon
	Painted	Kintiel
	Tie-dye	Lake Canyon
	Weft stripe	Laguna Creek, "Cornfields"
	Twill weaves, plain, reversed, herringbone, diamond and irregular	Lenaki
	Anasazi stripe patterns	Little Kiet Siel
	Brocaded twill	Marsh Pass, Cliff House #8
	Double weft twill	Monument Valley, Ruin #4
	Twill tapestry with interlocked wefts	Mesa Verde
	Warp-face band (loom woven?)	Mummy Cave
	Weft-float pattern weave	Navaho National Monument
	Brocaded weft-float pattern weave	Nitsie Canyon
	Weft-wrap openwork	Northern Arizona
	Non-loom weaves.	Olla House
	Plain weave tapestry bands	Painted Cave
	Rag-weft plain weave tapestry	Poncho House
	Weaving on a cylinder of warps	Sayodneechee, Monument Valley, Cliff House #2
	Weft-twine bands	
	Single element weaves.	Southeastern Utah
	Braiding, square, flat o-2 u-2, around a core	Southwestern Colorado
	Closed loop	Sunflower Cave
	Wrapped cord	Terrace House Ruin
	Articles made:	Tsegi Canyon
	Aprons or skirts. Fringed, well-made plain weave tapestry waist bands (non-loom), some crescent-shaped.	Tsegi Canyon, Cave 2
		Tsegi-ot-sosi, Monument Valley, Cave #8
	Bags. Plain weave, braid, closed loop, twill, woven on a cylinder of warps.	
	Blankets. Plain weave. Plain weave painted and tie-dye. Twill tapestry and Anasazi stripe twill. Longer dimension runs with weft stretch.	Turkey Cave
		Twin Caves

[1] See also Appendix A, Notes on the Bats Fiber Textiles Mentioned in the Text and Appendix B, chart 1, The Location, Age and General Contents of Sites Mentioned in the Text.

TABLE 6—*Continued*

Approx. Dates	Evidences of Cotton and Loom Weaving	Sources of Evidence[1]
	Breech cloths. Narrow woven cloth front, fringed. Plain weave, Anasazi twill (?), self-patterned twill, double weft twill, brocaded weft-float.	Two Mummy Ruin Vandal Cave
(P III)	Carrying bands. Plain weave tapestry (non-loom), weft-twine.	Waterfall Ruin
	Cradle bands. Plain weave, braid, plain weave tapestry (non-loom), warp-face (?).	White House Zele Cave
	Ponchos. Plain weave painted, and possibly Anasazi stripe twill.	
	Sandals. Rag-weft plain weave tapestry (non-loom), rag strip ties.	
	Sash. Plain weave, weft stripe. (Narrow cloths with decorated ends may be sashes. See also: Ties and belting.)	
	Shirts. Sleeveless, two-piece, poncho-like, painted plain weave. Sleeves, four-piece, painted plain weave. Sleeves, one-piece, braided.	
	Shoe socks. Closed loop, cotton plus animal hair.	
	Sling or carrying band. Flat braided center, long rope-like ends, braided around a core.	
	String-wrapped prayer sticks. Feathers tied with string.	
	Ties and belting. Flat braids.	
1100		
	Tools:	Bc 51
	Anchor holes for vertical loom in kiva floor (?)	Chaco Canyon
	Battens, small (?)	Chetro Ketl
	Loom end sticks, probably for belt loom	Pueblo Bonito
	Spindle whorls of squash rind, disk-shaped	Tseh So
(P II–IIIA)	*Techniques:*	
	Plain weave tapestry tump line (non-loom)	
	Plain weave, weft-face	
	Twill, Anasazi stripe pattern	
	Braid, flat 0-2 u-2 and square	
	Loom-woven fiber cloth (?)	
	Plain weave, weft-face	Floating House
	Plain weave, heavy decorative wefts	
	Plain weave breech cloth (painted?)	
(P II)	Twill	
	Anasazi stripe twill	
	Diamond twill	
	Braid, flat o-2 u-2	
	Loom woven plain weave apocynum fiber cloth with heavy decorative wefts	
900		
	Plain weave, weft-face	Tsegi Canyon, Cave 1, Middle Branch
	Brown and white check	
(P I)	Solid white (one sleeve-like object)	
	Plain weave tapestry tump line, cotton and hair (non-loom)	
700		
	Plain weave tapestry cradle band, all cotton (non-loom, date uncertain)	Broken Roof Cave
(BM III)	Cotton in cist with atlatl (?)	Deer Track Canyon
	Weft-twine fiber tump line, end loops bound with cotton (date uncertain)	Inscription House (small ruin near)
500		
(BM II)	Plain weave apocynum fiber cloth, warp-face, painted patterns (loom woven?)	White Dog Cave
300		

Techniques:

Loom weaves: Plain weave, weft-face.
Painted cloth.
Tie-dye.
A general elaboration of twill weaves with the distinctive Anasazi stripe twill cloth especially important.

Non-loom weaves: Closed loop.
Braids. Flat, over-two under-two.
Square and round.
Plain weave tapestry used for narrow bands.

Articles:

Aprons with a free-hanging fringe for women. These generally have a well-made tapestry weave waist band.
Bags. Closed loop and woven on a cylinder of warps.
Belts and ties. Braided.
Blankets. Wide, white plain weave for wear and burial shrouds. Wide blankets decorated by painting or tie-dye. Anasazi stripe twill blankets (probable).
Breech cloths for men. Narrow, fringed. Woven in plain weave or twill.

Shoe-socks. Closed loop with cotton-plus-wool string.
Shirts with sleeves, or sleeveless poncho-like upper garments for men. Painted cloth and perhaps Anasazi stripe twill.
Tump lines and cradle bands.

Pueblo cotton textiles

Plain weave cloth

Painting on cloth

Painted or twill weave shirts
Anasazi twill cloth
Aprons with tapestry waist bands and fringe

Closed loop footgear and bags

Flat braided ties, o-2 u-2 rhythm, ending in V point
Tump lines and cradle bands, tapestry & weft-twine, non-loom. Often with yucca warps, cotton wefts.

The obvious carry-over of ideas from Basketmaker to Pueblo horizons should make it clear that the introduction of the loom and of cotton among the Anasazi did not result in any sudden revolution of techniques. The new fiber they handled quite simply, at first, after the manner of bast or wool, gradually using it in place of these as it increased in supply through successful local cultivation. The loom they looked upon originally as a more efficient means of producing the type of fabrics to which they were already accustomed. From time to time influences from the south brought design ideas, new techniques and conventions in dress, but the established traditions were not profoundly changed by these until after 1300.

Within the Anasazi area there were probably a number of localized developments in weaving. Some of these may eventually be defined through well-documented excavation. The material presently at hand merely suggests that specialization did exist. Anasazi stripe twill, for example, seems to be especially characteristic of the Mesa Verde and Chaco Branch textiles. Twill tapestry has been recorded among the Anasazi only from villages of the Mesa Verde Branch, as has diamond twill and, with the exception of the double-weft cloth from Gourd Cave, three-heddle twill rigs. Reinforced selvages are conspicuous on cloth from Kiet Siel and Nitsie Canyon, and tubular-shaped wooden whorls are recorded only from Kayenta Branch sites. A few techniques show up in collections from the western fringe of the Anasazi area, though not in quantity. These may be present as the result of contacts with Wupatki and possibly the Upper Colorado River region after 1100. Included are: weft-wrap and possibly gauze from the Kayenta region, Nitsie Canyon, and Canyon de Chelly; brocaded weft-float designs on twill cloth from Kiet Siel, Grand Gulch, and White House; and an openwork, finger-weave shirt from White House.

Several of these techniques and articles can be shown to have stemmed directly from the pre-cotton textile industry of Basketmaker times. These relationships have been fully explored elsewhere in the text (see page numbers in the following list) and need not be repeated in detail here. Briefly they may be tabulated as follows:

Basketmaker bast fiber & wool textiles to which they relate

Plain weave apocynum cloth, BM II (Appendix A, p. 658).
Painted apocynum cloth, BM II (p. 565).
Painted fiber twined bags, BM II (pp. 564–565).
Painted fiber tump lines, BM III (p. 527).
Pictographs, BM (p. 565).
Twined bags, BM II (pp. 564–565).
Same, but with smaller waist band & long fringe, not free-hanging, BM III (pp. 617–618).
Similar articles in human hair or fiber, BM II–III (p. 589).
Flat braided dog hair sashes, BM II (pp. 600–601).
Same, generally yucca warp and soft fiber (apocynum?) weft, BM III (pp. 527, 583).

Of all recorded Anasazi collections, those from White House (and Canyon de Chelly) contain the greatest variety of weave techniques and articles.

SINAGUA AND SALADO WEAVING

Sinagua and Salado collections contain many elements stated to be characteristic of Anasazi Pueblo III weaving, but they exhibit a certain complexity of design and a number of techniques and articles which show up weakly or not at all in the northern material. Most of these are assumed to be present among the Salado and Sinagua as a result of mutual contacts between these groups and the Hohokam. It is probable that others are carry-overs from a Mogollon-Pueblo industry which developed in east central Arizona and perhaps southwestern New Mexico between 700 and 1100. It is assumed that this was essentially similar to Anasazi-Pueblo weaving in the methods, techniques, and types of articles woven, but with certain distinctive characteristics of its own. The fashioning of flat braids in over-three under-three rather than over-two under-two rhythm, and the manufacture of women's fringed aprons, but with a crudely made waist band, may have been two Mogollon variants of the general Pueblo pattern. The high percentage and variety of finger-weaves in collections from southwestern New Mexico (pp. 644–646) may represent another Mogollon-Pueblo distinction, and the use of stone "warping blocks" seems to be characteristic of the eastern part of the Mogollon area.

A number of traits can be classed with equal conviction as either Mogollon-Pueblo or Hohokam. These have been discussed in Chapters V and VI. One is the use made by Sinagua and Salado of basts in loom weaving, for rag-weft and plain fiber cloth, which may be explained either as the result of Hohokam contacts, or of a Mogollon tradition which arose in answer to a relative scarcity of cotton in east central Arizona and

TABLE 7

SINAGUA WEAVING, 900–1400

Approx. Dates	Evidences of Cotton and Loom Weaving	Sources of Evidence
1400	Fiber and seed	Camp Verde
	Spindle whorl, pottery, bead type	Cottonwood
		Honanki
	Techniques:	Kinnikinnick
	Braid, flat o-3 u-3	Montezuma Castle
	Brocade	Oak Creek Canyon
	Gauze	Palatki
	Plain weave, weft-face	Verde Valley
	Painted	Verde Valley Salt Mine
	Plaid	
	Rag-weft	
	Bast fiber cloth	
	Plain weave tapestry bands (non-loom)	
	Plain weave tapestry tie (loom-woven?)	
	Twill tapestry with interlocked wefts (diamond pattern)	
	Warp-face plain weave ties	
(P IV)	Weft-float pattern weave	
	Weft-wrap openwork	
	Wrapped cord	
	Articles made:	
	Aprons or skirts. Fringed, crudely-made waist band.	
	Bag. Weft-float pattern weave.	
	Blankets. Plain weave, longer dimension with weft stretch. Probably rag-weft and fiber cloth.	
	Breech cloths. Plain weave, long, unshaped or shaped, not loom-joined.	
	Carrying band. Plain weave tapestry (non-loom).	
	Cradle band. Plain weave tapestry (non-loom).	
	Ties and belts. Warp-face, braid, plain weave tapestry (loom woven?), wrapped cord.	
1300		
	Anchor holes for vertical loom in floor of kiva-like room (Juniper Terrace)	Hidden House
		Juniper Terrace
	Techniques:	Walnut Canyon
	Closed loop	Wupatki
	Embroidery	
	Plain weave, weft-face	
	Painted	
	Tie-dye	
	Plain weave tapestry (loom woven)	
	Plain weave tapestry band (non-loom)	
(P III)	Twill weaves, plain, reversed, irregular	
	Plain weave plus twill	
	Twill tapestry with interlocked wefts	
	Warp-face plain weave ties	
	Weft-wrap	
	Articles made:	
	Bags. Plain weave, closed loop (human hair string).	
	Blankets. Plain weave white and painted, longer dimension with weft stretch.	
	Breech cloths. Plain weave, long, shaped and usually loom-joined.	
	Carrying band. Plain weave tapestry (non-loom).	
	Cigaret "sash". Reversed twill.	
	Kilt. Plain weave with plain weave tapestry insets.	
	Quivers. Plain weave and twill tapestry.	
	Ties and belting. Warp-face plain weave.	
	Turban.	
1100		
	Fiber, no seed	Deadman's Drainage
(P II)	Plain weave, weft-face	Medicine Cave
	Plain weave square of cloth tied to form bag	San Francisco Mts.
	String	Walnut Canyon
900		

TABLE 8

THE THEORETICAL SOURCES OF SINAGUA WEAVING, 1100–1400

Date	Site	Pueblo	Hohokam	Hohokam or Mogollon-Pueblo
1400	Upper Verde Sites	Flat braid, 0-3 u-3 (Mogollon-Pueblo type) Fringed apron (Mogollon-Pueblo type) Painted cloth Plain weave tapestry, non-loom Plain weave, weft-face Twill tapestry Wide blankets	Bead-type pot-whorl Gauze Long, unshaped breech cloth Weft-float Weft-wrap	Brocade on plain weave Crude fiber & cotton skirt pads Plaid Plain weave bast fiber cloth Plain weave tapestry, loom-woven Rag-weft Shaped, but not loom-joined breech cloth Warp-face ties & belting
1200	Hidden House	Cloth bags Closed loop Painted blanket (Anasazi-Pueblo, Kayenta region) Plain weave, weft-face Wide blankets	Kilt Turban	Plain weave tapestry, loom-woven Shaped, but not loom-joined, breech cloth Warp-face ties & belting
	Wupatki	Plain weave, weft-face Shaped, loom-joined breech cloth (Mogollon-Pueblo type) Tie-dye Twills, self-patterned & tapestry	Cigaret "sash" Weft-wrap	Warp-face belting
	Walnut Canyon	Shaped, loom-joined breech cloth (Mogollon-Pueblo type)	Embroidery	Warp-face belting
1100	Juniper Terrace	Loom anchor loops (Anasazi-Pueblo)		

southwestern New Mexico in earlier horizons, and did not die out in Pueblo IV even in villages where cotton was plentiful. Openwork shirts and long woven breech cloths were probably Hohokam fashions, but the manufacture of the shirts by finger-weaving, and the trick of shaping and joining breech cloths on the loom may be Mogollon traits. Warp-rep ties and belts, plaid and brocade on plain weave cloth seem likely to be Hohokam introductions, but there is the possibility that they are Mogollon techniques acquired from Chihuahua, where they were apparently present around 300–400. Crude fiber-and-cotton skirts and clouts may be either Hohokam or Mogollon, or both. Probably present in Sinagua and Salado collections as a direct result of Hohokam contacts are: weft-wrap and gauze, embroidery, weft-float, warp-float, long breech cloths, kilts, a turban and a cigaret "sash."

Sinagua Weaving, 900–1400

There is no record of cotton in central Arizona before 900 and Pueblo II finds are scarce, consisting only of small scraps of weft-face plain weave cloth, cotton fiber, and string from sites in the vicinity of the San Francisco Mountains. Sinagua weaving in general is summarized in table 7. Table 8 attempts to show its mixed character between 1100 and 1400. Southern influence is especially marked in the late Pueblo III and IV sites of the Upper Verde. One trait which shows up no place except in Sinagua collections is the use of a six-thread twill rig. Cloths woven in this manner come from Wupatki, Hidden House, and Montezuma Castle.

Salado Weaving, 1250–1400

Weaving among the Salado peoples in the middle Salt River Valley between 1250 and 1400 is essentially similar to that of the Pueblo IV Sinagua in that it exhibits a combination of Anasazi-Pueblo, Mogollon-Pueblo, and Hohokam techniques. Pueblo type disk-shaped whorls are recorded from Canyon Creek and Kinishba. On the other hand, a wooden roller from Canyon Creek resembles the modern Pima ginning tool and may represent influence from the Desert people. A high percentage of thread at Tonto is exceptionally finely spun, which may indicate that the spindle used consisted of a slender shaft with bead-type whorl such as that found in Hohokam sites after 1100. So far as I know no specialized pottery whorls have been found in Salado villages. However, as Haury points out, they are found in jointly occupied sites like the University Indian Ruin and Martinez Hill, so that the Salado were certainly aware of them.[2] Probably both the belt loom and a wide loom were used, but there is no concrete evidence of either.

Basically Pueblo in character are: plain weave weft-face blankets and bags; tie-dye; painted cloth; self-patterned twills and twill tapestries; plain weave tapestry tump lines (non-loom); and small sacks woven on a cylinder of warps. Possible Mogollon-Pueblo specialties include: fringed aprons with crudely-fashioned waist bands; shaped, loom-joined breech cloths; twine-plaiting and flat over-three under-three braids. Acquired through Hohokam contacts were: embroidery, warp-float pattern weave, weft-wrap, and gauze. Either Hohokam or Mogollon-Pueblo in origin are: brocade on plain weave cloth, rag-weft, crudely-made fiber and cotton skirt pads, loom-woven plain weave tapestry, warp-face belting, plaid, long breech cloths, and an openwork shirt.

EASTERN MOGOLLON WEAVING, ?B.C.–1300

The earliest finds of cotton so far reported in the Southwest are from Tularosa Cave. They include thread dating to the time of Christ or before and cotton netting, spindle whorls (?), and a cloth-imprinted sherd in pre-700 horizons. As for actual loom-woven cotton cloth, we have examples only of plain weave (700–1200), weft-wrap and gauze (*ca.* 1000–1200), and diamond twill tapestry (1100–1200). Finger-weaving is represented not only by netting (500–700) but by two types of looping on foundation cords, braiding (flat over-three under-three and over-two under-

[2] Haury, correspondence, June, 1954.

TABLE 9

SALADO WEAVING, 1200–1400

Approx. Dates	Evidences of Cotton and Loom Weaving	Sources of Evidence
1400	Fiber, seeds, bolls (Tonto and Roger's Canyon Cliff Dwelling)	Canyon Creek Roger's Canyon Cliff Dwelling
	Tools (Canyon Creek):	Tonto
	Battens, wood	
	Ginning tool (?), roller type	
	Spindle whorls, disk-shaped, wood	
	Spinner's kit	
	Yucca leaf tip needles	
	Techniques:	
	Loom weaves.	
	Brocade	
	Embroidery	
	Gauze	
(P IV)	Plain weave, weft-face	
	Eccentric plain weave	
	Painted	
	Paired wefts	
	Plaid	
	Rag-weft	
	Tie-dye	
	Bast fiber cloth	
	Plain weave tapestry tie	
	Twill weaves, plain, reversed, irregular	
	Twill tapestry with interlocked wefts	
	Warp-face plain weave ties	
	Warp-float pattern weave	
	Weft-wrap openwork	
	Non-loom weaves.	
	Counterpaired warp-twine	
	Plain weave tapestry bands	
	Weaving on a cylinder of warps	
	Single element weaves.	
	Braiding; flat o-3 u-3 and 4-strand, square, braiding around a core	
	Twine-plaiting	
	Articles woven:	
	Aprons or skirts. Fringed, poorly made waist bands.	
	Bags. Plain weave, woven on a cylinder of warps.	
	Blankets. Plain weave; weft-face, longer dimension runs with weft stretch. Probably also rag-weft and bast fiber cloth.	
	Breech cloths. Plain weave and twill tapestry, loom-joined and shaped.	
	Carrying bands. Plain weave tapestry, non-loom.	
	Cradle band. Brocade.	
	Sash. Gauze weave.	
	Shirt. Twine-plaited.	
	String-wrapped bundle of rushes.	
	Ties and belting. Braided, flat and around a core; counterpaired warp-twine; plain weave tapestry (loom woven); warp-face plain weave; warp-float pattern weave.	
1300		
	Cloth-impressed clay	Kinishba
(P III)	Spindle whorl, disk-shaped, slate	
	Braid	
	Plain weave, weft-face	
	Bast fiber cloth	
	Twill, reversed	
1200		

TABLE 9—*Continued*

two, round and square), twine-plaiting and wrapped plaiting (*ca.* 1100). Figures on Mimbres pottery show the following articles of clothing: breech cloths, fringed sashes, and blankets extending below the waist. Techniques cannot be identified. In northwest Chihuahua plain weave warp-face fiber cloth, brocade on plain weave cloth, plaids and warp-face ties were woven in horizons which may date to 300 or 400, and brocaded and embroidered cotton or fiber cloth was produced around 1300. The relationship of the early development to Eastern Mogollon is not clear. It may represent the source from which loom weaving and certain techniques first reach the Pueblo area. The later Chihuahua finds reflect the movement into northern Mexico of Mogollon-Pueblo groups from southeastern Arizona (Appendix A, p. 659).

The number of Eastern Mogollon specimens is small and the range of loom techniques limited, although the examples that have been found are of excellent quality with regard to weave technique and fineness of thread. One explanation of the sparse finds may be that, whereas weaving among the Eastern Mogollon developed along the same lines postulated for the Mogollon-Pueblo area in general (pp. 642–644) perishable material simply has not survived in quantity. There is the possibility that cotton entered the Southwest from Chihuahua as early as the time of Christ, to be followed three or four hundred years later by spindle-spinning and the true loom with heddles. Certain weave techniques which show up in Sinagua and Salado collections may have been introduced with the loom to become standard Mogollon-Pueblo processes. This refers particularly to warp-face belting, plaid, and brocade on plain weave cloth.

A second possibilty is that the Mogollon of southwestern New Mexico were completely outside the main stream of developments in cotton weaving in the Southwest, which occurred, rather, as the result of influences from coastal Mexico on southern Arizona, and were spread from that area throughout the Hohokam sphere of influence and thence to the Anasazi. The Eastern Mogollon, even though the first to receive the cotton plant, may never have grown it to any extent locally,

preferring to import raw fiber from the Hohokam, and supplementing the supply thus acquired with bast fiber. There is a high proportion of finger-weaves in relation to the total number of textile finds, and considerable variety in the looping and plaiting techniques represented. It may have been characteristic of the Eastern Mogollon that they used the imported cotton chiefly in the manufacture of traditional pre-loom finger-weave fabrics, doing very little loom weaving. Woven cloth may, indeed, have been imported from Arizona. There have been no finds of seed, fiber or plant parts to indicate that cotton was grown locally, and, with the exception of one "warping block," no remains that can definitely be identified as loom parts or accessories have so far been recorded. It is tempting to draw a parallel between the lace-like finger-weave fabrics of the Eastern Mogollon and those known to have been present among the Indians of the southeastern United States.[4]

TABLE 10

EASTERN MOGOLLON WEAVING, ? B.C.–1300

Approx. Dates	Evidences of Cotton and Loom Weaving	Sources of Evidence[3]
1300	*Tools:*	
	Needles, yucca leaf tip	Bear Creek Cave
	Stone warping blocks (Delgar Ruin)	Delgar Ruin Doolittle Cave Greenwood Cave
	Techniques:	Mimbres pottery representations
	Loom weaves.	Mule Creek Cave
	Gauze	Sapillo Creek
	Plain weave, weft-face	Cliff Ruin #7
	Twill, diamond twill tapestry with interlocked wefts combined with plain weave	Sipe Canyon, Cave #5 Tularosa Cave
	Weft-wrap openwork	
	Single element weaves.	
	Braiding, flat o-2 u-2 and o-3 u-3, square with ornamental rings on fringe, round	
	Looping on foundation cords, two types	
	Twine-plaiting	
	Wrapped plaiting	
	Articles made:	
	Aprons or skirts. Fringed, crudely made of bast and cotton string.	
	Blankets (Mimbres pottery)	
	Breech cloths (Mimbres pottery)	
	Breech clouts. String.	
	Quivers or sleeves. Plain weave and weft-wrap openwork.	
	String-wrapped cane cigarets.	
	Ties and belting. Flat braids, fringed.	
1000	Needles, yucca leaf tip	Cordova Cave
	Spindle whorls (pottery) and shafts (?)	Tularosa Cave
	Thread	
	Plain weave, weft-face	
	String-wrapped cane cigarets	
700	Cloth-impressed sherd	Tularosa Cave
	Netting	
	Spindle whorls (pottery) and shafts (?)	
500	Thread	Tularosa Cave
? B.C.		

[3] Finds from Casas Grandes and caves of northwestern Chihuahua are not listed on this table because their relationship to cotton weaving in southwestern New Mexico is not clearly understood. The Mexican finds include:

ca. 1300: Bast fiber and/or cotton cloth—brocade; embroidery; plain weave, usually warp-face. Blankets.

ca. 400: Bast fiber cloth—brocade; plain weave warp-face, some with plaid patterns; warp-face ribbon or tie. Blankets, longer dimension running with weft-stretch; tie.

WEAVING IN THE HOPI COUNTRY, 1300–1550

A general knowledge of the nature of textiles woven in the Hopi towns between 1300 and 1550 may be had from studying the clothing shown on mural figures at Kawaika-a and Awatovi. The fabrics illustrated exhibit a combination of Pueblo and late southern characteristics. Anasazi-Pueblo traits were brought into the Hopi country by people from the Kayenta area and Canyon de Chelly at the time of the desertion of the San Juan shortly after 1300. These people were responsible for establishing the use of the wide vertical loom, set up in the kiva, and for the disk whorl spindle. Anasazi-Pueblo textile traditions were profoundly affected after 1300 by the coming of Sinagua groups and people from the Upper Little Colorado River to the Hopi Mesas. It was at this time, rather than after European intervention, that basic changes in technique and design occurred which account for the major differences that exist between modern Pueblo and prehistoric Anasazi-Pueblo textiles.

A number of techniques and articles of clothing appear to be illustrated in the murals (fig. 142). These are enumerated in the following list. Question marks are placed after those items which may have been interpreted incorrectly. Some are classified as Anasazi-Pueblo and others as Southern. Included in the latter group are traits assumed to be of Hohokam origin and also those which may be Mogollon-Pueblo, but which are in any event not characteristic of northern Pueblo weaving before 1300.

1. Anasazi-Pueblo.
   - Blanket dresses
   - Closed loop footgear (?)
   - Cloth shirts
   - Painted cloth
   - Self-patterned twill (?)
   - Tapestry weave (?)
   - Tie-dye

[4] Lorant, 1946. The textiles from Spiro Mound which I have seen in the collections of the University of Oklahoma, are all done by finger-weaving with a free-hanging warp. See also: Holmes, 1896 and Hamilton, 1952.

2. Southern.
   - Elaborate tassels
   - Embroidery
   - Kilts
   - Openwork shirts and kilts which may be weft-wrap, gauze, braid or twine-plaited
   - Warp-float belting
   - Wide braided rain sashes

Plain weave cloth, small shoulder blankets and various types of belting and ties were probably common to all parts of the Southwest. While I have assigned the elaborate tassels to southern influence, nothing like them has so far been recorded from any prehistoric site, and they have survived historically only in the form of complex tassels on the traditional white wedding robe. The absence in the murals of broad, white cloth sashes with decorated ends is curious. These have been historically a standard feature of dance costume, and it seems likely that some of the prehistoric narrow woven cloths with decorated end borders were sashes.

The murals represent, essentially, ceremonial costume. Certain articles of dress which we believe to have been in everyday use are not shown. This includes breech cloths, fringed aprons, men's and women's ordinary shoulder blankets and belting, fur cloth blankets and footgear. In my opinion, the plaid shoulder blankets traditionally worn by Hopi men and boys today were introduced from the the south at this time (pp. 494–496), and warp-float belting began to replace the narrow white braids which had been universally used by Puebloan people up until 1400. The traditional braided belt survived for ceremonial wear in the exaggeratedly wide form we know it—the "rain sash," which appears for the first time prehistorically in the Jeddito murals (pp. 601–602). Striped Anasazi twill blankets were probably also in use, here and in the northern Rio Grande, as their shape and pattern seem to be reflected in the wide, striped Navaho "chief" blankets of the 1800's (p. 565). It was between 1400 and 1550 that embroidery began to supplant earlier techniques for the making of elaborately patterned fabrics and certain characteristics of design which appear on embroidered cloth of historic Indians made their appearance (pp. 635–637).

TABLE 11

WEAVING IN THE HOPI COUNTRY, 1300–1550

Approx. Dates	Evidences of Cotton and Loom Weaving	Sources of Evidence
1550	Fiber, seed	Awatovi
	Anchor loops for vertical looms in kiva floors	Kawaika-a
	Spindle whorl (?), disk-shaped, stone	Kokopnyama
	Stone warping blocks	
	Murals:	
	Probable techniques represented.	
	Braid, probably tubular frame braiding	
(P IV)	Elaborate tassels	
	Embroidery	
	Openwork weave, either weft-wrap, gauze, braid, twine-plaiting, closed loop or netting	
	Painted cloth	
	Plain weave	
	Tapestry weave (?)	
	Tie-dye	
	Twill (?)	
	Warp-float pattern weave belting	
	Probable articles of clothing represented.	
	Belts	
	Blankets	
	Small shoulder blankets	
	Blanket dresses	
	Garters	
	Hair ties	
	Kilts	
	Sashes	
	Shirts, solid cloth and openwork, with and without sleeves	
	Socks (?), closed loop	
1300		

WEAVING IN THE NORTHERN RIO GRANDE PUEBLOS, 1200–1550

Evidence of weaving in the northern Rio Grande is limited. Anasazi-Pueblo tradition is reflected in the presence of loom anchor loops in the floors of Pueblo III and IV kivas from Poshu on the Chama south to Kuaua. Only plain weave cloth, white and black, has been found. This comes chiefly from burials on the Pajarito Plateau. A fabric which might be twine-plaiting or gauze, and a curious sort of pile cloth on cotton netting are reported from Pecos, but these are too poorly preserved for accurate analysis. Also found at Pecos were disk whorls and wooden weaving combs resembling Anasazi Pueblo III types, bone battens, and eyed needles comparable to material from Hawikuh, and a specialized pottery whorl thought to be of north Mexican origin.[5] Murals at Kuaua show figures dressed in plain, black kilts and with wide white sashes at their waists. These sashes are not fringed after the fashion of modern "rain" sashes.

Early Spanish records indicate the people dressed much as we know them today—the men in woven breech cloths or kilts, the women in blanket dresses and belts, and both sexes wearing shoulder blankets. Striped blue and white wearing blankets are mentioned especially by Espejo.[6] Textiles were more elaborately patterned than the archaeological record for the Rio Grande shows, as there are accounts of painted or embroidered cloth, and a reference which sounds like a description of weft-wrap or gauze.[7]

It appears that there was a blending in the Rio Grande, as in the Hopi country, of Anasazi-Pueblo and

[5] Kidder, 1932: 222–227, 291–292, 301–302, 334.
[6] Bolton, 1916: 174.
[7] *Ibid.*, 177. Winship, 1896: 562.

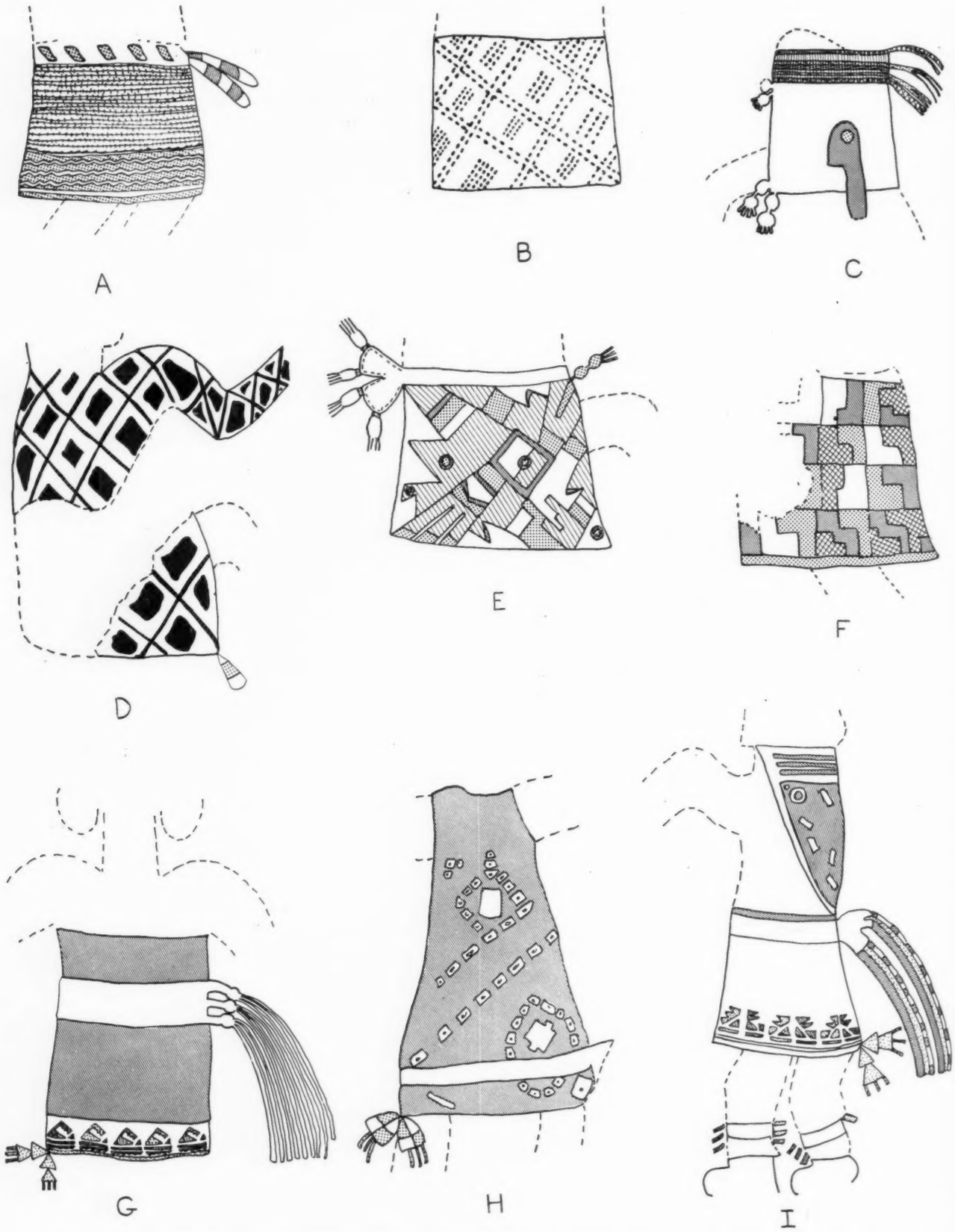


FIG. 142. Costume details from the Jeddito murals illustrating textile techniques and styles in Pueblo IV in the Hopi country.

southern traditions. The northern Pueblo weave complex was probably carried into the region by groups from the Chaco, Mesa Verde, and Aztec between 1200 and 1300, to be modified after that time by influences from the Salado peoples of Arizona. Since Salado and later Sinagua weaving were so nearly alike, the influences brought to bear on the Anasazi in the Rio Grande Pueblos must have been basically similar to those affecting the Hopi. My impression is, however, that they were not nearly so profound in the east. Certainly the dance costumes illustrated at Kuaua do not approach in elaborateness of design those in the Jeddito murals. At the time of Spanish intervention it was the custom among the New Mexico peoples, as it is today, to import some of their woven cloth from the Hopi, a fact which indicates that even then weaving was a less important—or less elaborate—craft among the Eastern Pueblos than it was in Arizona.

HOHOKAM WEAVING, ?700–1400

There is no evidence of cotton in southern Arizona before 700, although it may well have been present there by the time of Christ, inasmuch as the finds from Tularosa Cave indicate that the plant had been carried as far north as the Southwest by then. Cotton weaving became a well-developed craft before 1000, almost certainly characterized by a number of highly decorative weaves of which weft-wrap openwork and gauze were the most distinctive.

Since we assume that certain techniques, tools, and woven articles which do not appear to any great extent in Anasazi Pueblo III collections are present in Sinagua and Salado sites as the result of Hohokam influences, we should envision Hohokam weaving as including not only the traits listed in table 13, but also the following: brocade on plain weave cloth, loom-woven plain weave tapestry, warp-float and weft-float pattern weaves, long breech cloths, kilts, and turbans.

The presence in Ventana Cave of noticeably warp-face blankets, longer than wide, may indicate that a stationary loom unlike the Pueblo vertical type was used. It seems reasonable to infer that this was a horizontal loom like that of the Pima.

TABLE 12

WEAVING IN THE NORTHERN RIO GRANDE PUEBLOS, 1200–1550

Approx. Dates	Evidences of Cotton and Loom Weaving	Sources of Evidence
1550	Fiber	Estancia Basin Frijoles Canyon
	Thread	Jemez Cave Kuaua
	Anchor loops for vertical loom in kivas	Paa-ko
	Spindle shaft wound with cotton thread	Pecos Poshu Puaray
	Plain weave, weft-face, white and black	Puyé Te'ewi Tyuonyi
	Plain weave square of cloth folded to make small sack	Unshagi
	Plain weave blankets (fragments only)	
	Murals (Kuaua): Plain weave black kilts Wide white sashes, not fringed	
	Pecos: Bone battens; bone eyed needles; disk whorls; one pottery bead whorl (Mexican); wooden weaving comb; gauze?; pile cloth, yucca fiber on cotton net.	
1200		

FIG. 142.

A. Kilt. The artist may have attempted to represent a twill weave cloth, such as Anasazi-stripe twill. (Smith, 1952*b*: fig. 24, *e* and 52, *a*.)
B. Openwork kilt. The technique represented here is probably weft-wrap openwork, twine-plaiting or braiding. (*Ibid.*, fig. 24, *g* and 67, *d*.)
C. Kilt with elaborate corner tassels. The belt is probably a warp-patterned weave like the conventional Pueblo belt of today. (*Ibid.*, fig. 50, *c*.)
D. Shirt with sleeves, probably depicting a plaiting or braiding technique. (*Ibid.*, fig. 24, *a* and 65, *c*.)
E. Kilt with a complex pattern. The mural probably illustrates a painted cloth. (*Ibid.*, fig. 24, *l* and 67, *b*.)
F. Kilt, possibly of plain weave tapestry. (*Ibid.*, fig. 24, *i* and 51, *d*.)
G. Plain weave black dress with lower border decorated (probably) by embroidery, and with elaborate corner tassels. The sash represented is undoubtedly a wide, white braided wedding sash of the kind made today by frame-braiding. (*Ibid.*, pl. I.)
H. Sleeveless shirt or poncho-like garment, probably decorated by a tie-dye pattern. (*Ibid.*, fig. 24, *c* and 50, *c*.)
I. Figure wearing small tie-dye shoulder blanket (?) and kilt with an embroidered (?) border and elaborate corner tassels. (*Ibid. pl.* I.)

WEAVING IN SOUTHERN ARIZONA AND AMONG THE PUEBLO INDIANS SINCE 1550

SOUTHERN ARIZONA

Weaving among the Hohokam of southern Arizona between 1000 and 1400 was apparently characterized by a variety of techniques and decorative processes resulting in elaborately patterned fabrics, and by the use of a specialized pottery spindle whorl of the bead type. Some of the techniques and designs, carried north and northeast by Sinagua and Salado peoples, are still practiced today by the Hopi and a few other groups. However, between 1400 and the early 1700's all the elaborate weaves disappeared from southern Arizona. Only plain weave red and white blankets, "skirts," breech cloths and narrow warp-float bands are mentioned in eighteenth-century reports on the Indians of that area, in spite of the fact that cotton was still grown in great quantity until 1900. Accounts of Pima and Maricopa weaving between 1850 and the early 1900's describe un-

TABLE 13

WEAVING IN SOUTHERN ARIZONA, ?700–1900

Approx. Dates	Evidences of Cotton and Loom Weaving	Sources of Evidence
1900	Cotton cultivated	Bartlett, 1854
	Cross-bar spindle	Castetter and Bell, 1942
	Horizontal loom	
	Plain weave blankets, solid red or white. Surviving examples are weft-face, but longer dimension runs with warps.	Hrdlička, 1905 Russell, 1908 Spier, 1933 USNM collections from Pima Indians
	Plain weave "skirts" (folded blankets) and breech cloths.	
1700	Loss of all elaborate decorative techniques except warp-float pattern weave	
1400	*Tools:*	Bat Cave
	Needles, yucca leaf tip and yucca spine	Casa Grande
	Spindle whorls, pottery, bead type	Double Butte Cave Graham County Hieroglyphic Pass Cave
	Techniques:	
	Braid, flat 0-2 u-2	Las Acequias
	Embroidery	Los Muertos
	Gauze	Olberg, cave near Solomonsville
	Plain weave	Southern Arizona
	Paired warps, check pattern	Tucson Mountains
	Warp-face blankets	Ventana Cave
	Weft-face	Winchester Cave
	Twill, self-patterned	
	Warp-face belting	
	Weft-wrap openwork	
	Articles made:	
	Blankets. Warp-face plain weave, longer dimension runs with warp stretch.	
	Breech clouts. String and rag strip.	
	Ceremonial objects. Cigaret "sashes," string-wrapped prayer sticks, paired disk sherds wrapped with string.	
	Ties and belting. Flat braid and warp-face bands.	
1100	Spindle whorls, pottery, bead type	Los Guanacos Snaketown
	Plain weave, weft-face	
	Twill, plaid pattern	
	Weft-wrap openwork	
900	Cotton seed	Grewe Site
700		

decorated plain weave and warp-float belting. Cigaret "sashes" were made until recently according to the Pima. The Indians of southern Arizona no longer weave cloth. Historically, the paucity of decorative techniques, the absence of multiple-heddle weaves, the crossbar spindle, and horizontal loom differentiate the weaver's art in southern Arizona from that of the Pueblos.

A COMPARISON OF PREHISTORIC AND MODERN PUEBLO INDIAN WEAVING

We have already cited Spanish records indicating that cotton weaving was practiced in the Rio Grande Valley as far north as the Chama, in the Zuni country, at Acoma, and among the Hopi in the 1500's. Loom-woven cloth was the basic source of Pueblo Indian clothing. Between 1540 and 1879, when James Stevenson began collecting their textiles for the Smithsonian Institution, many influences were brought to bear on Pueblo weaving which changed its character decidedly from that of prehistoric times. Stevenson found no openwork, damask (weft-float pattern weave?), or slit tapestry. Embroidery and brocade (Hopi type) were the important decorative techniques, and plain weave and self-patterned twill cloths were woven.[8] Some of the differences are, of course, the direct result of the European contacts, but others represent a process of internal change which included the invention of a few new techniques, the discarding or modification of old ones and a shift of emphasis from weaves which had been important in Pueblo III and IV to some which were present but not stressed prehistorically.

There are few clues with which to reconstruct the order of events in which these changes occurred. The Rio Grande people were forced under the encomienda system between 1600 and 1800 to weave quantities of blankets for shipment to Mexico, but none of these have survived, so far as we know. Scraps of cloth from post-Spanish Hawikuh are of plain weave cotton only. Textiles from Awatovi, most of which date from the Spanish period (1600–1700) are in part imported from Mexico or Europe, and in part native-woven. Plain weave, twill, round braiding, and warp-face ties are representative of the latter. Leake found cotton, apocynum, sheep wool, and flax used in woven cloth and braids. The flax was imported in the form of woven cloth (linen) from Europe, but wool was apparently widely used as a textile fiber in the Southwest by 1600. Other fibers found in Awatovi textiles in the form of thread and cordage are: bison and deer hair, rabbit fur, feathers, and juniper bark.[9]

Some time before 1700 the Pueblo people taught the art of weaving to the Navaho. This probably occurred in the Governador area of northwestern New Mexico, whence people from some of the Rio Grande towns went as refugees fearing Spanish reprisals after the revolt of 1680. The basically Pueblo character of early Navaho weaving is obvious,[10] and serves as proof that Pueblo weaving at that time included the manufacture of wide blankets, blanket dresses, shirts with sleeves, weft-striped twill, and plain weave. The stripes on Navaho (and probably Pueblo) textiles of the early 1800's were very thin and either grouped into bands or

[8] Douglas, 1940*a*: 167.
[9] Leake, mss., n.d.
[10] Amsden, 1949: pls. 60–63.

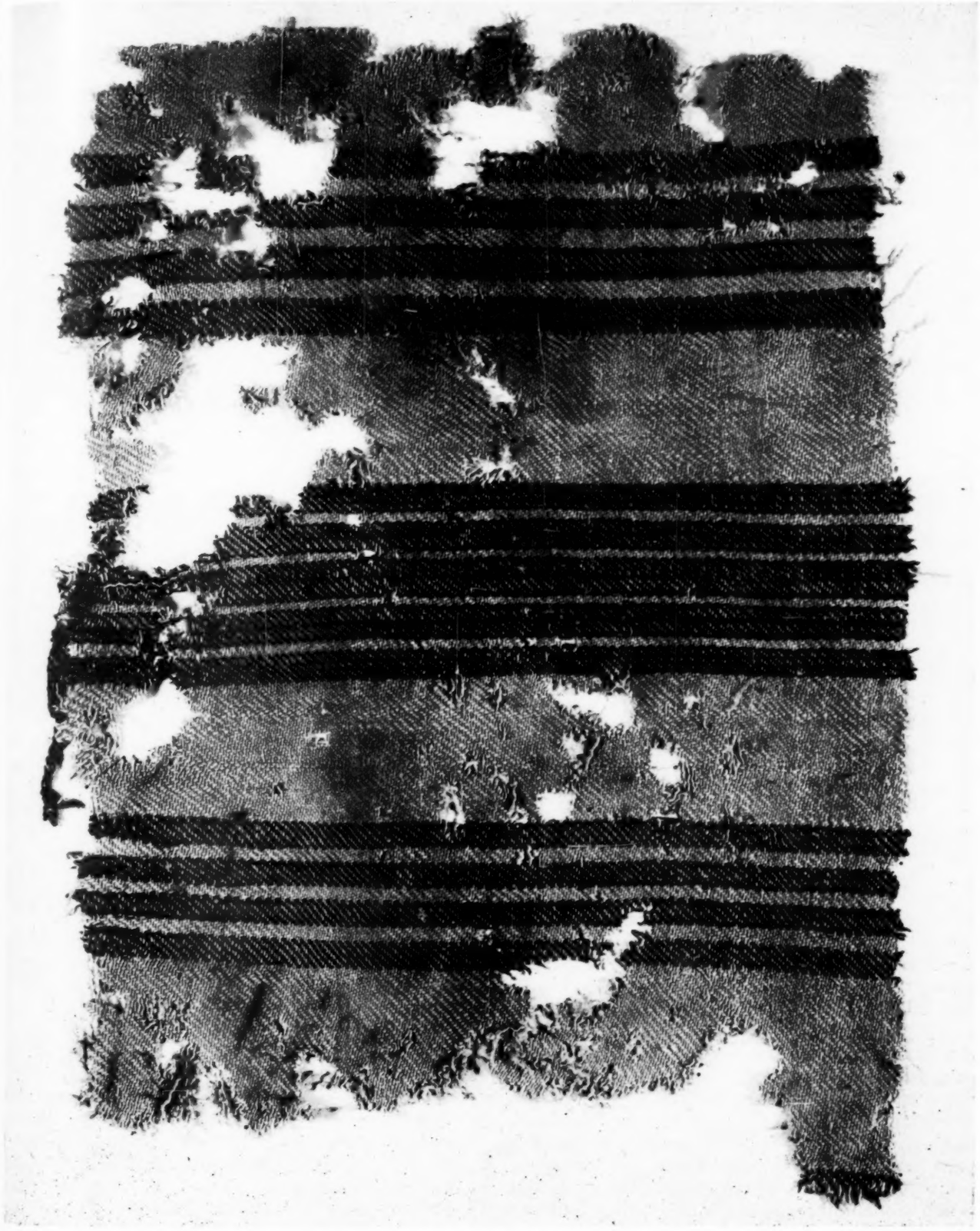


FIG. 143. Fragment of wool blanket, dating to 1805, from Massacre Cave, Canyon del Muerto. This is thought to be of Navaho manufacture. (Photo by Brooklyn Museum.)

spaced evenly over the surface of the blanket. A similar kind of weft-striping has been observed on Anasazi-stripe cloth (fig. 81, F). It was mentioned by Espejo for the Rio Grande in 1583 [11] (fig. 143).

With the coming of the railroad in the early 1880's, commercial cloth, factory-made blankets, and clothing were made available to the people. The art of weaving began to die out. It is now done mainly in the Hopi towns, although there are several weavers at Zuni and a handful of them scattered through the Rio Grande villages. The rain sash and warp-patterned belting are the only articles in general production in the latter area. There has recently been a revival of weaving in cotton and embroidery in the Indian Service schools of New Mexico and a number of young women and girls have learned it, thus taking over an art which was traditionally carried on by the men.

Changes due to European Influence

European influence has been brought to bear on Pueblo weaving in four areas: materials used, technical processes, design, and the type of articles woven. By far the most profound effects are those in the first category. Sheep were introduced in quantity by the Spanish in the early 1600's, and the Pueblos learned to spin and weave the wool, handling it in the manner already established for cotton. Handspun wool is still woven at Hopi and Zuni. Other sources of wool yarn before 1875 included bayeta cloth, which was ravelled for embroidery yarns, chiefly red, and a limited amount of imported three-ply Saxony yarn used in the same way. After 1880 a commercial American wool yarn, called Germantown, was purchased by the Indians for embroidery and belting. Handspun cotton is still used to some extent, although commercial cotton batting has become the major source of the fiber, rather than native-grown cotton. Around 1890 commercial cotton string began to be substituted for handspun cotton as warpage, and this has been increasingly used for both warps and wefts of cotton garments. Some cotton sacking, a commercial cloth resembling native plain weave material, is now substituted for hand-woven cloth. New dyes as well as fibers and yarns were introduced by Spanish and Americans. Indigo blue was imported from Mexico at an early date and became a standard Pueblo dye. After 1880 commercial aniline dyes, distinguished by their harsh and brilliant tones, were sold to the Indians. These were not used as indiscriminately as among the Navaho, so that Pueblo textiles have never presented the garish appearance characteristic of certain Navaho blankets and rugs. Recently the Museum of Northern Arizona has fostered a revival of the use of native vegetable dyes by Hopi weavers.

There has been no basic change in technical processes as a result of European intervention. The reed heddle was used with the belt loom for a time, but is not now in favor. Cards for combing wool fibers have been adopted for both wool and cotton by native spinners, a kitchen fork replaces the pre-Spanish wooden weaving fork, and a steel needle is used for embroidery. Two non-loom techniques, knitting with needles and crocheting, were accepted by the Pueblo and used principally to create the traditional openwork shirts and footgear which had been made by looping and plaiting techniques prehistorically. This change probably occurred in early Spanish times. There is a piece of knitted wool, possibly of native manufacture, from a refugee Tewa site (1680–1700) in Frijoles Canyon and another from seventeenth-century Awatovi. In the field of design European influence is equally limited, consisting basically of one floral element in embroidery.[12]

The demands of the tourist trade have resulted, especially in the Rio Grande villages, in a concentration on warp-patterned belting, which may be readily sold. Among the Hopi, it has brought about the weaving of rugs instead of wearing blankets, and of brocaded table runners. The substitution of commercial cloth for native-woven material in traditional articles of wear becomes increasingly more noticeable, particularly in the dance costumes of the New Mexico Pueblos. Breech cloths, kilts, and sashes are apt to be of commercial cloth nowadays.

Internal Changes in Pueblo Weaving

The techniques used in prehistoric and modern Pueblo Indian weaving are compared in table 14. From this it becomes apparent that the following processes disappeared: all non-loom techniques except flat braiding, many forms of twill, gauze, weft-wrap, tie-dye, twill tapestry, true brocade, weft-float, and painting on cloth (except for a few ceremonial articles). A new type of brocade, a new embroidery stitch, and two European finger techniques have been added since 1550. Warp-float belting, wide, frame-braided rain sashes, and embroidery have become especially important. The trend in this direction was established before 1550, judging from the Awatovi murals.

In the field of design, negative patterning and the zoning of embroidery patterns, both prehistoric ideas, still survive. Small, geometric tapestry patterns have largely disappeared to be replaced on tapestry weave cloth by weft stripes and a few large geometric figures. Some of the design elements formerly expressed in twill tapestry, painting, tie-dye, weft-wrap, brocade and weft-float have been carried on in embroidery. Embroidery on kilts has shifted from a band placed around the lower edge of the garment to bands placed on each warp border. One European motif appears in embroidery.

Products of the loom today are in general very coarse and heavy by comparison with prehistoric cottons. The industry has become static. A few standard articles

[11] Bolton, 1916: 174.

[12] Mera, 1943: 16.

TABLE 14

A COMPARISON OF PREHISTORIC AND MODERN PUEBLO TEXTILE TECHNIQUES

Prehistoric	Modern
Loom weaves:	
Brocade	"Brocade," Hopi type
Embroidery	Embroidery
Running-stitch	Modified back stitch with double thread.
Twine-stitch	– – – – – – – – – – – – – – – –
Double running-stitch	– – – – – – – – – – – – – – – –
Wrap-stitch	– – – – – – – – – – – – – – – –
Gauze	– – – – – – – – – – – – – – – –
Plain weave, weft-face	Plain weave, weft-face
Eccentric	– – – – – – – – – – – – – – – –
Heavy wefts	– – – – – – – – – – – – – – – –
Painted	– – – – – – – – – – – – – – – –
Paired warps or wefts	– – – – – – – – – – – – – – – –
Plaid and check	Plaid and check (most are twills)
Rag-weft	– – – – – – – – – – – – – – – –
Tapestry (most are non-loom narrow bands)	Tapestry, weft-striped blankets longer than wide (rugs)
Tie-dye	– – – – – – – – – – – – – – – –
Twill weaves	Twill weaves
Anasazi stripe	– – – – – – – – – – – – – – – –
Diagonal	Diagonal
Diamond	Diamond
Double weft	– – – – – – – – – – – – – – – –
Herringbone	Herringbone
Reversed	Reversed
Tapestry patterned	– – – – – – – – – – – – – – – –
Twills with broken rhythm	– – – – – – – – – – – – – – – –
Twills with brocade or inlaid wefts	– – – – – – – – – – – – – – – –
Twills with plaid pattern	Twills with plaid patterns
Warp-face belting and ties	Warp-face belting and ties
Warp-float belting and ties	Warp-float belting and ties
Weft-float pattern weave	– – – – – – – – – – – – – – – –
Brocaded	– – – – – – – – – – – – – – – –
Weft-wrap openwork	– – – – – – – – – – – – – – – –
Non-loom weaves:	
Braids	Braids
Flat, narrow belts and ties	Flat, wide sashes, frame-braided
Square and round	– – – – – – – – – – – – – – – –
Around a core	– – – – – – – – – – – – – – – –
Shirt	– – – – – – – – – – – – – – – –
Closed loop; looping on cords	– – – – – – – – – – – – – – – –
Cylindrical warp weave	– – – – – – – – – – – – – – – –
Netting	– – – – – – – – – – – – – – – –
Twine-plaiting; wrapped plaiting	– – – – – – – – – – – – – – – –
Warp-twine, counterpaired	– – – – – – – – – – – – – – – –
Weft-twine	– – – – – – – – – – – – – – – –
	Crochet
	Knitting

are made, but experimentation has ceased, and there is far less variety and complexity in the loom processes today than in prehistoric times. Articles made at the present time which find their counterparts in prehistoric collections are: wide blankets for wear as shoulder blankets or women's dresses, kilts, breech cloths, belts, braided sashes, openwork footgear and shirts, cloth shirts with or without sleeves, and narrow ties.

CONCLUSIONS

Loom weaving with cotton in the Southwest must, in the last analysis, be thought of as the most northerly manifestation of a complex originating, in the New World, in coastal Peru. It is based on a fiber and a tool imported from Mexico along with certain weave processes, articles of clothing, and perhaps design ideas. These influences did not arrive in a body, but rather as a series of impulses affecting various parts of the Southwest over a long period of time, from the beginning of the Christian Era into the early historic period. Most probably entered the area via the Hohokam from the west coast of Mexico. Others may have come through the Mogollon in southwestern New Mexico from the northwestern plateau of Chihuahua.[1]

[1] *Cf.* Haury, 1945*c*.

Cotton weaving in this area exhibits certain basic similarities to its parent industries in Peru and intervening regions. However, as might be expected, it developed along somewhat different lines, giving it a set of characteristics peculiarly its own which distinguish the products of its looms from cloth produced in centers to the south. Certain techniques which had been used in making articles of bast, wool, or human hair before the introduction of cotton and the loom were carried on, utilizing the new fiber and sometimes adapted to the new device. The influences of these indigenous processes on the new art can be quite plainly demonstrated by Anasazi textiles. Traditional basketry and mat patterns were copied in loom-woven cloth. Introduced weaves were simplified or elaborated, and a limited number of new processes developed through independent experimentation. As in Peru, two basic looms were utilized—a belt loom suitable for narrow fabrics, and a wide loom with stationary end beams, developed primarily for the weaving of large blankets. The wide loom apparently took two forms, appearing as a vertical frame in the Pueblo area, and a horizontal frame among the Hohokam. The belt loom, at least north of the Mogollon Rim, was less important than the stationary loom. This contrasts with the situation from central Mexico south into Peru, where the belt loom was the basic type. This difference in method may account for certain characteristics of shape and appearance that distinguish Southwestern textiles from aboriginal material farther south, particularly in pre-Spanish Peru.

Weaving developed along somewhat different lines in various parts of the Southwest so that we are able to distinguish several regional styles between 1000 and 1550. It appears that there may have been one generally similar development for the Pueblo area as a whole with, however, a number of weaving centers. One, in the Anasazi-Pueblo province, established a style for northern Pueblo textiles. Another possibly in east central Arizona south of the Upper Little Colorado River, was the source of Mogollon-Pueblo elements which were carried to the Flagstaff area, the Upper Verde, and the Middle Salt Valleys. In the latter regions weaving was strongly affected through contacts with the Hohokam of southern Arizona. Hohokam weaving was subject to a number of influences from Mexico between 1000 and 1400 which gave it more variety and complexity of technique and design than is shown in Anasazi Pueblo III work. A movement of peoples from the Verde Valley and Little Colorado River north and northwest to the Hopi country and from the Middle Salt northeast to New Mexico around Zuni, and ultimately the Rio Grande Valley, in late Pueblo III and IV carried many of these complexities to areas where the Anasazi-Pueblo pattern was basic.

After the coming of the Spanish in 1540 new types of fibers, two European finger-weave processes and one European design element were introduced into Pueblo weaving, but there was little basic change of techniques. The gradual break-down of the art of weaving began probably in the early 1800's, to be hastened by the coming of the railroad, commercial goods, and tourists after 1880. The relationship of modern Pueblo weaving to that of pre-Spanish times is easily demonstrated in spite of the changes that have occurred in the craft between 1540 and 1954.

GLOSSARY

Anasazi stripe twill. A self-patterned twill cloth distinguished by black or brown, red and white weft bands of varying width.

Bast. In this publication the term "bast" refers to fibers taken from the stalk or leaves of certain uncultivated plants, as apocynum and yucca, and to bark fiber.

Batten. Also called "sword." "The shaped piece of wood by means of which the shed is kept open for the weft yarn, and each inserted weft is driven down to the partially woven web. The word is both noun and verb." (O'Neale, 1937: 215.)

Braiding. The inter-twining of three or more cords or yarns from a single point or plane downward. The yarns are not distinguished as warps and wefts.

Brocade. A brocaded fabric is one in which geometrical designs are built up as the weave progresses by alternating a pick of decorative yarn with a pick of basic weft. The decorative yarns float over selected groups of warps.

Carding. The process of aligning fibers preparatory to spinning.

Closed loop. A single element technique in which the thread is crossed once on itself after encircling the loop above it.

Couching. The appliqué of cord or string to the surface of a cloth is called "couching."

Counterpaired warp-twine. In warp-twine two adjacent warps are twisted a half-turn about each other between each pick of weft. If the warps of adjacent pairs are turned towards or away from each other, thereby forming a plaited effect, the weave is called "counterpaired warp-twine." (*Cf.* O'Neale, 1937: 215.)

Cylindrical warp weave. A weave used to create small, seamless sacks. The warps are arranged so as to form a cylinder around which the weft is woven continuously in weft-float or twill rhythm.

Design. "The general term to be applied to any decorative pattern or part thereof." (Douglas, 1941: 124.)

Double running-stitch. "An embroidery stitch in which the material passed over by the needle on the first line of running stitches is covered by a second line." (O'Neale, 1937: 215.)

Eccentric plain weave. A plain weave in which the treatment of warps and wefts varies every few weft picks. (Fig. 10, H.)

Element. "The simplest complete design in any pattern." (Douglas, 1941: 124.)

Embroidery. The decoration of cloth after its removal from the loom by the insertion of yarns with a needle. *See also:* double running-stitch, running-stitch, twine-stitch, wrap stitch and false twill embroidery.

False twill embroidery. A form of running-stitch embroidery by which twill patterns are created on the cloth.

Finishing needle. A slender stick 12 to 18 inches long and with a sinew loop near one end. The last few weft picks are drawn through the web with the help of this "needle," the weft being fastened to the loop.

Float. A warp or weft thread which is not interwoven with any other threads, but is allowed to run free for a distance on the surface or reverse side of the fabric.

Floated weaves. Fabrics on which a pattern is built by warp or weft floats are called "floated weaves." The term includes twills, weft-float and warp-float pattern weaves.

Frame-braiding. A form of braiding wherein the yarns are passed continuously around two end rollers or fastened between two sticks. Any step executed at one end of the course of yarns is automatically duplicated in reverse at the other end.

Gauze weave. A weave in which the odd-numbered warps are crossed over the even-numbered warps and held in this position by a passage of the weft, thus creating a line of openwork. One or more openwork rows alternate with plain weave sections.

Ginning. The process of separating cotton fiber from the seed.

Half-basket weave. A plain weave in which warps or wefts are paired.

Heddle. A device for separating the warps into what are called sheds for the insertion of weft. In the Southwest the heddle is a rod to which string loops are fastened. The loops encircle a selected set of warps. When the heddle is pulled, the warps attached to it are separated from the rest by being brought forward (or up, in the case of the horizontal loom). (*Cf.* O'Neale, 1937: 216.)

Loom. A frame on which warp threads are fastened. A true loom is equipped with heddles. Three types of looms are described in the text: the vertical loom, the horizontal loom and the belt loom. (Pp. 483–486.)

Loom anchor loops. Loops set into the floor to which the lower bar of the vertical loom may be fastened. Similar loops in the banquettes of Mesa Verde kivas served as anchor points for the upper rollers of belt looms.

Loom-joined breech cloth. A breech cloth in which the front fold was secured while the piece was under construction on the loom. (Pp. 609–610.)

Looping. A single element weave. The process of building a fabric from a continuous series of interlocking coils. Three types of looping are described in the text: closed loop (pp. 587–589), netting (pp. 591–593) and looping on foundation cords (p. 589–591).

Motif. "The design, either element or unit, which is strongest in a pattern and forms the base thereof." (Douglas, 1941: 124.)

Negative design. "A treatment of decorated areas wherein certain open spaces between the masses of whatever medium is applied to a surface, are so planned as to form patterns in themselves and which thus become of principal interest." (Mera, 1943: 9.)

Netting. Netting is a form of looping in which the thread is knotted to the mesh above it rather than simply carried through it.

Pattern. "The complete design, simple or complex, formed by the repetition or combination of elements." (Douglas, 1941: 124.)

Pick. "One length of weft from side to side of a design motive (in tapestry), or of a breadth of fabric in the loom. The term is used both as a noun and as a verb meaning to insert the weft in the shed." (O'Neale, 1937: 216.)

Plain weave. A weave in which single weft threads interlace over and under single warp threads.

Plaiting. A single-element weave wherein all the yarns are fastened at a single point or along one plane, generally with ends free-hanging, and are intertwined from that point downwards. Three types of plaiting are described in the text: braiding (pp. 593–603), twine-plaiting (pp. 603–605) and wrapped plaiting (pp. 590–591).

Ply. A twist of yarn or thread. The word "ply" may also be used as a verb meaning "to twist." *Single-ply:* Fibers twisted into a single continuous thread by one spinning. *Two-ply:* Two threads plied, or twisted, together into a yarn.

Rag-weft cloth. A cloth in which weftage consists, in whole or in part, of cotton rag strips or bundles of cotton thread.

Rep. A markedly warp-face cloth, generally having a corded appearance.

Running-stitch. An embroidery or darning technique in which the yarn is carried over and under the surface of a cloth in stitches of any desired length.

Saddler's stitch. "A seaming stitch which laces the edges of two webs together without overlapping." (O'Neale, 1937: 217.)

Selvage. The special treatment accorded the edge of a woven cloth with a view to strengthening it.

Shed. The triangular space opened between sets of warps by means of the heddle or shed rod for the insertion of the weft.

Shed rod. A rod passed behind a selected set of warps, by means of which a shed may be opened for passage of the weft.

Single element weaves. Weaves which are not carried out with separate warps and wefts, but with single lengths of thread interlaced with one another in looping or plaiting techniques.

Single warps wound. "A method by which a very narrow line of color is produced. A single warp or a single warp group is wrapped closely with weft yarn." (O'Neale, 1937: 217.)

Spindle. A device for twisting fibers together into one continuous strand, or thread. In the Southwest, the spindle consists of two parts: a slender stick, or shaft, 10 to 30 inches long and pointed at one or both ends; and a whorl, or weight, affixed to the shaft between its center and one end.

Spinning. The twisting of fibers together into one continuous thread.

Square count. An equal number of warps and wefts to the unit of measurement, in this publication, one inch.

S-spun. A thread in which the individual fibers are twisted together so as to trend in the same direction as the diagonal center line of the letter *S*, when the thread is held in vertical position.

S-twist. A yarn composed of two or more plies which are twisted together so as to trend in the same direction as the diagonal center line of the letter *S* when the yarn is held in vertical position.

Tapestry. A weave in which wefts are battened so closely together as to conceal the warps completely, and in which patterns are built from blocks of different colored wefts. No one weft passes from edge to edge of the web, but each is woven back and forth over a limited number of warps. *Kelim, or slit, tapestry:* A tapestry in which slits are left at the edges of color blocks since weft threads do not interlock at points of contact, but turn instead about adjacent warps. *Interlocking tapestry:* If wefts of different colors loop around each other at points of contact so that no slits are left in the cloth, the technique is called interlocking tapestry. *Monochrome tapestry:* If wefts are passed from edge to edge of the web no design of color units is woven, and the piece is simply an exaggeratedly weft-face cloth. Sometimes such a cloth is called a monochrome tapestry. *Plain weave tapestry:* A tapestry in which wefts are inserted over-one under-one warp, as for regular plain weave. *Twill tapestry:* A tapestry woven in twill rhythm.

Tenter. (Temple.) A flat, slender stick about an inch wide and grooved at regular intervals. This is fastened by each end to the outer warp threads and lies behind the web just below the work area. The tenter serves as a guide by means of which the width of the web may be kept constant as weaving proceeds.

Textile. Cloth woven from spun fibers.

Thread count. The number of warps or wefts to the unit of measurement; in this publication, one inch.

Tie-dye. Tie-dye is a simple form of resist dye wherein the cloth is folded together at certain points and wrapped tightly with string. Dye subsequently applied to the cloth cannot penetrate the wrapped areas and they are left to form a white pattern against the colored background.

Tubular warp. The stringing of warps around the loom rollers or end bars so that they form an unbroken tube and can be pulled around over the bars like a roller towel. This rig can be used with any type of loom. In the Southwest, it is usually employed in weaving narrow bands and belts.

Twill weaves. Twill cloth may be recognized by the diagonal ribs which extend across the fabric. These ribs are made by the regular floating of wefts in echelon over two or more warps at a time. *Plain twill:* a twill in which the ribs slant across the fabric in one direction from one side to the other. This is also called a "continuous twill." *Reversed twill:* A twill in which the diagonal ribs reverse direction at regular intervals so as to form vertical zigzag lines on the fabric. *Herringbone twill:* A twill in which zigzag lines run horizontally from side to side of the cloth. These lines are really composed of a series of half-diamonds touching at their edge points, and warps are strung for diamond twill. *Diamond twill:* A twill in which the ribbing forms diamond patterns on the fabric. *Irregular twill:* A twill in which the ribbing forms patterns or figures (other than diamonds and regular zigzag lines) on the surface of the cloth. "Fancy," "figured," and "broken" twill are other terms sometimes used for this type. *Brocaded twill:* A twill patterned by brocade wefts. *Double-weft twill:* A form of twilling in which two wefts of contrasting colors are inserted in each shed. The first weft passes over every other set of depressed warps in the shed, and the second weft passes over the warp sets skipped by the first. *Self-patterned twills*: Twills in which the pattern effect depends solely on the arrangement of the lines of floats. *Twill tapestry:* Tapestry woven with a twill rhythm. *See also:* Anasazi stripe twill.

Twine-plaiting. A single element weave in which all threads are fastened along a single plane and twisted together from the top downward. Adjoining threads make one or more twists about each other, separate to become units of new pairs and then return to their original positions.

Twine-stitch. An embroidery or darning technique wherein a thread is run through the cloth over and under two or more warps or wefts at a time and then doubled back and passed along the same course crossing over the threads skipped on its first passage. The needle is inserted first at one side of the original line of stitches and then at the other, giving the effect of two threads twisting around foundation elements as in twined basketry.

Unit. "The simplest complete design which is a combination of two or more elements." (Douglas, 1941: 124.)

Warp. "The yarns stretched on the loom preparatory to weaving. The completed warp series is called the set-up." (O'Neale, 1937: 218.)

Warp-face. "The appearance given to a fabric by a preponderance of warp yarns over the number of weft yarns per inch." (O'Neale, 1937: 218.) *See also:* Rep.

Warp-float pattern weave. In warp-float pattern weave a design is built up by warp floats on the surface of the cloth.

Warping block. A chunk of sandstone roughly a foot square and with a shallow depression or socket on one surface into which the end of a pole or roller used in winding the warp will fit.

Web. "A textile fabric, especially one under construction on the loom." (O'Neale, 1937: 218.)

Weft. (Woof, filling, pick.) "The yarn carried by a bobbin or shuttle from one side to the other across the warps in weaving." (O'Neale, 1937: 218.)

Weft-face. The appearance given to a fabric in which wefts predominate over warps. A weft-face cloth wherein warps are nearly or completely obscured by wefts is called a tapestry.

Weft-float pattern weave. In weft-float pattern weave a design is built up by weft floats on the surface of the cloth.

Weft-twine. In this weave wefts are used in pairs. They

clasp one or more warps at a time, make a half-turn about each other, and then clasp the next warp or warp set. Weft-twine is a common basketry technique.

Weft-wrap openwork. Weft-wrap is a technique used in creating openwork designs on plain weave cloth. Small holes are made by drawing apart certain warps and wefts and wrapping them with selected weft threads.

Whorl. The weight affixed to the spindle shaft to furnish momentum as the shaft is twirled. Three types have been found in the Southwest: a flat disk made of wood, potsherd, slate, horn or gourd rind; a bead-like form moulded from pottery clay; and a simple stick fastened at right angles to the shaft.

Wrapped plaiting. A form of plaiting in which all yarns are fastened at a single point and one of them is then passed around the others, wrapping once about each in its passage and forming a net-like cylinder.

Wrap-stitch. An embroidery stitch whereby the yarn is wrapped once or twice around a given number of warps between two wefts, then carried across one weft and wrapped about a second set of warps to left or right of the first.

Z-spun. A thread in which the individual fibers are twisted together so as to trend in the same direction as the diagonal center line of the letter *Z*, when the thread is held in vertical position.

Z-twisted. A yarn composed of two or more plies which are twisted together so as to trend in the same direction as the diagonal center line of the letter *Z* when the yarn is held in vertical position.

APPENDIX

A. NOTES ON THE BAST FIBER TEXTILES MENTIONED IN THE TEXT

Four major classes of bast fiber cloth have been referred to in the text because of the relationship they bear to the cotton material under consideration. These are: Anasazi-Basketmaker finds; woven basts thought to be contemporary to the Basketmaker material and from northwestern Chihuahua; fiber cloth from Pueblo III and IV Sinagua, Salado, Hohokam, and Eastern Mogollon sites; and material of comparable date from northwestern Chihuahua.

ANASAZI–BASKETMAKER

Basketmaker textiles employ, in addition to basts, human and animal hair. The following list summarizes briefly the basic techniques used and articles woven.

Basketmaker II (300–500).

Aprons, three types.
- Shredded cedar bark, free-hanging fringe.
- Bast fiber string.
- Human hair, weft-twine, rectangular cloth 10½ × 9½ inches.

Bags, two types.
- Bast fiber, weft-twine. Very fine weave, painted or woven patterns.
- Bast fiber or human hair, closed loop.

Belts, two types.
- G-strings of bast fiber or human hair string.
- Dog hair or wool (unidentified) flat braided sashes.

Blankets, two types.
- Bast fiber (called apocynum) plain weave cloth, painted.
- Rabbit fur string, weft-twine.

Cordage.
- Bast fiber.
- Human hair.

Tie.
- Bast fiber, warp-twine.

Tump lines.
- Bast fiber or human hair. Warp-face plain weave, non-loom products.

Basketmaker III (500–700).

Aprons.
- Bast fiber. Plain weave tapestry (non-loom) or weft-twine waist pads with long fringe.

Bags, two types.
- Bast fiber, weft-twine. Coarse weave, undecorated.
- Bast fiber, closed loop.

Blankets.
- Rabbit fur string, weft-twine.

Sandals.
- Bast fiber thread, painted and woven patterns.

Tump lines (all non-loom products, and all bast fiber).
- Plain weave tapestry, painted or woven designs.
- Plain weave, warp-face.
- Weft-twine, painted.

The relationship of several of these items to Anasazi-Pueblo cottons is summarized on page 642. Of special significance are the Basketmaker II plain weave apocynum cloths. These are described as weft-face. One is decorated by painting. The design on another is created by rubbing a weft with color for a short distance and then weaving it in. The only complete example is about 27 inches square.[1] These cloths must have been woven on a fixed-warp frame. If the frame was equipped with a string loop heddle, as may well have been true, it means that the loom was present in the Anasazi area perhaps 400 years before our first good evidence of cotton, in 700.

EARLY CHIHUAHUA (*ca.* 300–400)

The textiles in question are woven from apocynum fiber. Nearly all are markedly warp-face. The technique is usually plain weave, one-over-one. Sometimes, however, warps or wefts, or warps and wefts, are handled in pairs. The cloths are patterned by warp stripes, plaid or brocade. Brocading is done in small units spaced apparently at random on the surface of the cloth. The fabrics appear to be fragments of blankets or shawls. Two complete examples are broader than long, which is characteristic of Pueblo cotton blankets. There is a fragment of a narrow tie, a plain weave rep with paired wefts.[2]

Technical features of special interest include the insertion of fill-in wefts to "even" the weave, and the use of multiple bobbins. The first of these practices has been noted in a fragment of cotton plaid cloth from Tonto. It is assumed that two or more bobbins were used for the cotton plaids and checks from Ventana Cave and the Verde Salt Mine (pp. 493–494). Neither technicality has been recorded in northern Pueblo weaving.

If these cloths were loom-woven, the horizontal loom is likely to have been the form employed. In spite of the appearance of rep and brocade on plain weave cloth in this early period, these two techniques do not seem to have been widespread in Pueblo III, but are found only in Hohokam, Sinagua and Salado collections.

PUEBLO III AND IV BAST FIBER CLOTH

By Pueblo III in the Anasazi area cotton had apparently replaced bast fiber for loom-woven fabrics, and was substituted as weftage—and sometimes also as warpage—in non-loom textiles such as tump lines and cradle bands. Plain weave bast fiber cloth and fiber

[1] Guernsey and Kidder, 1921: 63–65.
[2] O'Neale, 1948.

cloth with cotton rag wefts was relatively common farther south among the Sinagua, Salado, possibly the Eastern Mogollon, and the Hohokam.

LATE CHIHUAHUA

Fabrics from northwestern Chihuahua thought to date from Pueblo III and IV are woven from cotton, or from bast fiber decorated with cotton thread. The techniques include brocade and running-stitch embroidery on plain weave cloth. Designs are comparable to the complex geometric tapestry patterns of Pueblo III and IV textiles in general. The extensive use of bast in Chihuahua may reflect a scarcity of cotton fiber in that area.

B. THE LOCATION, AGE AND GENERAL CONTENTS OF SITES MENTIONED IN THE TEXT

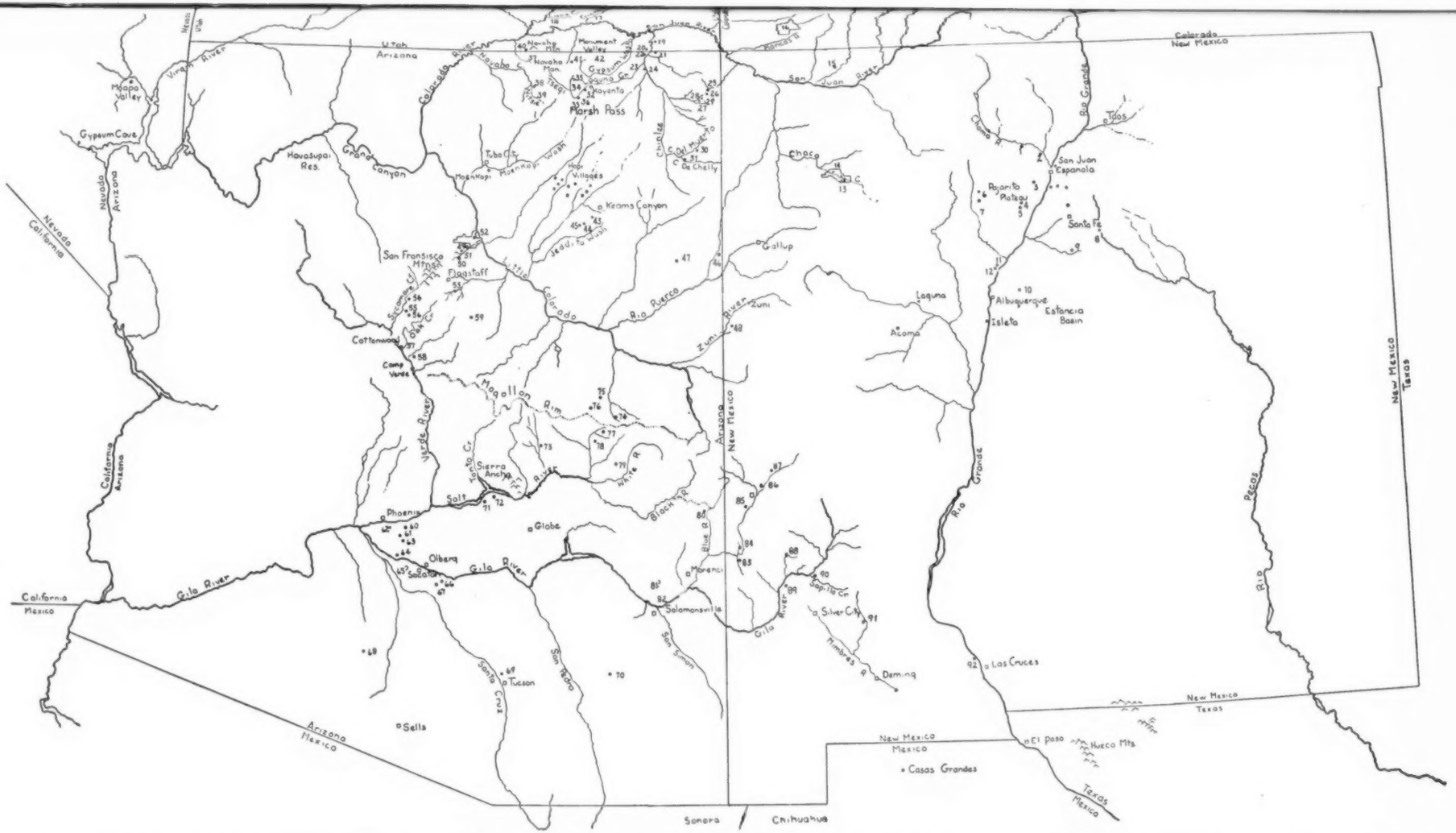
CHART 1. AN ALPHABETICAL LIST OF SITES REFERRED TO IN THE TEXT, WITH A STATEMENT ON THE AGE, GENERAL CONTENTS AND PRINCIPAL BIBLIOGRAPHICAL REFERENCES FOR EACH

The age given for a site refers to that part of it from which the textile material or evidences of loom weaving mentioned in the text came. Tree ring dates are given when known. The authority for these is generally Smiley, 1951 or Smiley *et al.*, 1953, and this is noted in the last column (Sources) with bibliographical references.

The culture period is given if the general features of the site indicate what it should be. A question mark accompanies all dates or culture period designations of doubtful validity.

Information in the column headed "Sources" includes the institutions or collections where material now rests, and also general bibliographical references to sites and/or textile finds. Page numbers in a reference are given if the information it contains on textiles might otherwise be difficult to locate.

Site	No. on Map	Culture Per. and/or Dates	Finds	Sources
Awatovi	45	P IV	Murals with textile representations. Loom anchor holes in kiva floors.	Smiley, 1951. Smith, 1952*b*.
Aztec	15	P III 1110–1125 ?–1275 (Mesa Verde Annex)	Seeds and fiber; thread. Disk whorls and yucca needles; batten? Plain weave; plain weave tapestry tump line; twill breech cloth?; Anasazi twill blanket; diamond twill, Anasazi design. (Nearly all are mummy wrappings from Mesa Verde annex.)	AMNH, CU, NPS-AM. Brand, 1935. Morris, 1919 & 1924. Smiley, 1951.
Bat Cave, Catalina Mountains	69	?	Plain weave cloth rectangle made like cigaret "sash" but larger.	ASM.
Bat Woman House, Tsegi Canyon	34	P III 1275	Plain weave breech cloth.	UU.
Bc 51, Chaco Canyon	13	P II–III	Plain weave; weaving tool?	Kluckhohn & Reiter, 1939: 36, 96, 97.
Bear Creek Cave	80	P III (*ca.* 1100?)	String. Weft-wrap; gauze; square braid fringe with ornamental rings.	USNM. Hough, 1914.
Bear Ruin	77	600–800	Lower loom bar marks in kiva floor?	Haury, 1940: 45–47.
Betatakin	36	P III 1242–1276	Loom anchor holes. Disk whorls. Plain weave; sandal with rag wefts.	ASM. MNA. Judd, 1930. Smiley, 1951.
Black Creek LA #1521	46	P III?	Anasazi twill.	LA.
Bluff Site	78	*ca.* 400	Perforated sherd disk, whorl?	Haury & Sayles, 1947.
Broken Flute Cave, Lukachukai Mountains	25	BM II	No cotton. Braided dog hair sashes.	Amsden, 1949: pl. 3.
Broken Roof Cave	22	BM III	Cotton in cist with atlatl (questionable).	PM A5597. Guernsey, 1921: 37–40.
Camp Verde	—	P III–IV?	Specialized pottery whorl. Plain weave; plain weave blanket on mummy; plain weave breech cloth; rag-weft?	ASM. USNM. Hough, 1914: 73.
Canyon Creek	73	P IV 1323–1348	Fiber. Cordage. Battens; disk whorl; ginning tool?; spinner's kit; yucca needles. Plain weave; plain weave dyed red and brown; plain weave, warp-stripe?; painted cloth; tie-dye; brocaded cradle band; rag-weft; rag and fiber fringed skirt; string-wrapped bundle of rushes; 4-strand flat braids; round braids at blanket corners; bag; blanket. Weft-wrap.	Haury, 1934. Smiley, 1951.



MAP 13. The location of sites referred to in the text. (1) Poshu. (2) Te'ewi. (3) Puyé. (4) Tyuonyi. (5) Frijoles Canyon. (6) Unshagi. (7) Jemez Cave. (8) Pecos. (9) Galisteo Basin. (10) Paa-ko. (11) Kuaua. (12) Puaray. (13) Tseh So, Bc 51. (14) Chetro Ketl, Pueblo Bonito. (15) Aztec. (16) Mesa Verde. (17) Grand Gulch. (18) Lake Canyon. (19) Poncho House. (20) Floating House. (21) Waterfall Ruin. (22) Broken Roof Cave. (23) Laguna Creek, "Cornfields," Olla House. (24) Ford House. (25) Broken Flute Cave. (26) Obelisk Cave. (27) Vandal Cave. (28) Hospitibito Canyon. (29) Painted Cave, Gold Tooth Canyon, Deer Track Canyon, Zele Cave. (30) Canyon del Muerto, Mummy Cave. (31) Canyon de Chelly, White House. (32) White Dog Cave. (33) Marsh Pass, Cliff House #8, Kinboko Canyon (Ruin A, Marsh Pass), Sunflower Cave. (34) Tsegi Canyon, Bat Woman House, Cedar House, Eagle's Nest, Lenaki, Terrace House Ruin, Turkey Cave, Twin Caves. (35) Kiet Siel. (36) Betatakin. (37) Navaho National Monument. (38) Inscription House, small ruin near. (39) Nitsie Canyon, Cave Town Ruin, Chilchintaboko, Gourd Cave, Little Kiet Siel, Two Mummy Ruin. (40) Forbidden (Forbidding?) Canyon. (41) Tsegi-ot-Sosi. (42) Monument Valley. (43) Kokopnyama. (44) Kawaika-a. (45) Awatovi. (46) L.A. 1521. (47) Kintiel (Wide Ruin). (48) Hawikuh. (49) Juniper Terrace, NA 1814 F. (50) Medicine Cave, NA 863. (51) Deadman's Drainage, NA 998. (52) Wupatki. (53) Walnut Canyon. (54) Hidden House. (55) Honanki. (56) Palatki. (57) Oak Creek. (58) Montezuma Castle. (59) Kinnikinnick. (60) Las Acequias. (61) Los Guanacos. (62) Double Butte Cave. (63) Los Muertos. (64) Snaketown. (65) Hieroglyphic Pass. (66) Grewe Site. (67) Casa Grande. (68) Ventana Cave. (69) Bat Cave. (70) Winchester Cave. (71) Roger's Cliff Dwelling. (72) Tonto National Monument. (73) Canyon Creek. (74) Showlow. (75) Four Mile Ruin. (76) Pinedale. (77) Bear Ruin. (78) Bluff Site. (79) Kinishba. (80) Bear Creek Cave. (81) McEuen Cave. (82) Graham County. (83) Mule Creek Cave. (84) Sipe Canyon. (85) Cordova Cave. (86) Delgar Ruin. (87) Tularosa Cave. (88) Mogollon Creek Cave. (89) Greenwood Cave. (90) Sapillo Creek, Cliff Ruin #7. (91) Doolittle Cave. (92) Chavez Cave.

CHART 1—*Continued*

Site	No. on Map	Culture Per. and/or Dates	Finds	Sources
Canyon de Chelly	31	P III?	Plain weave; Anasazi twill. (*See also* White House.)	AMNH. BM. NMSM.
Canyon del Muerto	30	P III?	Weft-twine tump line. (*See also* Mummy Cave.)	AMNH.
Casa Grande	67	1200–1400	Specialized pottery whorls. Weft-wrap; possibly rag-weft.	USNM. Fewkes, 1907 & 1912. Gladwin, 1928. Hough, 1914: fig. 163
Casas Grandes	—	P IV	Plain weave.	NMSM.
Cave Town Ruin, Nitsie Canyon	39	P III?	Plain weave; weft-wrap.	ASM.
Cedar House, Tsegi Canyon	34	P III?	Plain weave.	PM.
Chaco Canyon	—	P II–III	Plain weave. (*See also* Pueblo Bonito, Chetro Ketl, Bc 51, Tseh So.)	NMSM.
Chavez Cave	92	P III?	Netting.	Cosgrove, 1947: fig. 82.
Chetro Ketl	14	P II–IIIa 911–1116	Plain weave; Anasazi twill; flat braid, o-2 u-2; square braid.	NMSM. Smiley, 1951.
Chilchintaboko, Nitsie Canyon	39	P III?	Plain weave; closed loop.	ASM.
Cordova Cave	85	700–1000	Spindle shafts; yucca needles; cordage.	Martin *et al.*, 1952: 205–211, 347, 408.
Cottonwood	—	P III–IV?	Weft-wrap; warp-patterned tie found with mummy of child.	ASM.
Deadman's Drainage NA 998	51	P II	Plain weave; cloth-impressed sherd.	MNA. Bartlett, 1934.
Deer Track Canyon	29	BM or P?	Twined-weft fiber tump line with end loop reinforced with cotton cord.	ASM.
Delgar Ruin	86	P III	Sandstone warping block.	Hough, 1914: 15.
Doolittle Cave	91	P III?	Plain weave; weft-wrap; cords.	PM. Cosgrove, 1947: 7–9.
Double Butte Cave	62	P III–IV?	Plain weave and twill cigaret "sashes"; cotton thread and string, white, red, yellow, blue, black.	Haury, 1945*a*.
Eagle's Nest, Tsegi	34	P III?	Plain weave.	ASM.
Estancia Basin	—	P IV–V	Cotton cord and fabrics.	Brand, 1935: 202–209.
Floating House	20	BM through P II. No stratification	Plain weave; plain weave breech cloth, possibly painted; diamond twill; Anasazi twill; plain weave with heavy decorative wefts; braid o-2 u-2 flat. (Also well-woven apocynum cloth.)	PM.
Forbidden (Forbidding?) Canyon	40	P III?	Plain weave tapestry tump line.	UM.

CHART 1—*Continued*

Site	No. on Map	Culture Per. and/or Dates	Finds	Sources
Ford House Ruin	24	P III	Plain weave.	PM. Guernsey, 1931: 40–44.
Four Mile Ruin	75	P III–IV	Sandstone warping blocks.	Fewkes, 1904: 154–160.
Frijoles Canyon	5	P IV	Loom anchor loops in nearly every kiva floor. Mummy wrapped in white plain weave blanket (Large Cave Kiva); black dyed plain weave; small cloth sack containing blue earth.	NMSM. Hewett, 1909. Hewett, 1938: fig. 59
Gold Tooth Canyon (or Buttress Canyon)	29	P III?	Plain weave.	ASM.
Gourd Cave	39	P III	Wood whorls, disk and tubular. Fiber and seed. Plain weave; plain weave bag; plain weave blanket around mummy; plain weave tapestry cradle band; tie-dye; running-stitch embroidery; twill designs; warp-face band; double-weft twill breech cloth; braids—square, flat o-2 u-2; sandal with rag wefts; sandal ties of cotton rag; closed loop medicine bag; closed loop shoe-sock with animal hair.	ASM.
Graham County	82	?	Weft-wrap.	USNM.
Grand Canyon	—		Cotton fiber.	MNA.
Grand Gulch	17	P III 1132–1135 (Also BM. No stratification)	Batten; bone needles?; disk whorls; seed beaters; weaving comb. Plain weave; plain weave bag; plain weave cradle band; twill, Anasazi; diamond twill tapestry blanket; brocaded weft-float design on twill cloth; braid, o-2 u-2 flat; flat braid sewed to make small bag.	AMNH. Smiley, 1951.
Greenwood Cave	89	P III?	Cordage. Looping over foundation cords —2 types.	PM. Cosgrove, 1947: 9, 76.
Grewe Site	66	500–900	Charred cotton seed. (Probably dates between 700–900.)	McGregor, 1941: 155. Woodward, 1931.
Gypsum Cave	—		Cotton.	Harrington, 1933: 195.
Hagoe, Cliff Houses #5 & #6, Monument Valley	42	P III?	Plain weave.	PM. Kidder & Guernsey, 1919: 40–46.
Hawikuh	48	P IV–V	Bone "battens"; bone eyed needles. Plain weave.	MAI. Hodge, 1920. Smiley, 1951.
Hidden House	54	P III (*ca.* 1250)	Plain weave; plain weave bags; plain weave blankets, one painted with black designs; plain weave breech cloth; plain weave kilt with tapestry insets; plain weave tapestry quiver; twill tapestry quiver; warp-face and warp-patterned belting; closed loop quiver bottom, turban of hanks of yarn. (All with burial of man.)	ASM. Dixon, 1956.
Hieroglyphic Pass Cave	65	P IV?	Plain weave cigaret "sashes."	MNA.

CHART 1—*Continued*

Site	No. on Map	Culture Per. and/or Dates	Finds	Sources
Honanki	55	P III–IV?	"Cotton and agave cloth," possibly rag-weft.	USNM. Fewkes, 1896: 272.
Hospitibito Canyon	28	P III?	Anasazi twill; braid, flat o-2 u-2 ending in square braid fringe extending from *V* point.	LA.
Hueco Mountains, Cave #8	—	P III?	Cotton netting. Cotton cordage. (This is called a Pueblo ceremonial cave.)	Cosgrove, 1947: 39 & fig. 82, *b*.
Inscription House, small ruin near	38	?	Plain weave tapestry cradle band found on "trash mound of small ruin near Inscription House, Anasazi, 500–700." (ASM catalogue.)	ASM.
Jemez Cave	7	P IV?	Mass of charred and matted fragments of what appear to be plain weave cotton cloth.	NMSM.
Juniper Terrace, NA 1814 F	49	P III 1123–1175	Loom anchor loops in pit house or kiva floor.	Colton, 1946: 152–155.
Kawaika-a	44	P IV 1357–1495	Cotton seeds with grave offerings. Murals with textile representations.	Hough, 1903: 341. Smiley, 1951. Smith, 1952*b*.
Kayenta area	—	P III?	Plain weave; painted cloth; tie-dye; Anasazi twill; weft-wrap; gauze; closed loop shoe-sock of wool plus cotton string.	AMNH. ASM. Haury, 1934: 99. Kidder & Guernsey, 1919: 106–107.
Kiet Siel	35	P III 1100–1284 (Mostly 1270–1284)	Loom anchor holes in kiva floor. Wood whorls, disk, tubular and rectangular. Plain weave; tie-dye; plain weave tapestry tump lines and skirt band; twine- and running-stitch embroidery; Twills—Anasazi, o-3 u-1 and o-2 u-2 with brocade wefts; wrapped cord; weft-wrap; closed loop; braids—flat o-2 u-2 and square.	MNA. Guernsey, 1931: 62–64. Smiley, 1951.
Kinboko Canyon, Ruin A, Marsh Pass	33	P III	Plain weave.	PM. Kidder & Guernsey, 1919: 61–66.
Kinishba	79	P III 1223–1306	Slate spindle whorl, disk-shaped. Plain weave; twill, o-2 u-2; braid. Cloth-impressed clay; charred cloth; yucca cloth.	Baldwin, 1939: 321. Cummings, 1940: 68–69. Smiley, 1951.
Kinnikinnick	59	P III–IV 1147–1320	Plain weave tapestry band.	MNA. Smiley, 1951.
Kintiel (Wide Ruin)	47	P III 1255–1280	Loom anchor holes in kiva floors.	Haury & Hargrave, 1931: 86–87, 92. Smiley, 1951.
Kokopnyama	43	P IV 1254–1430	Loom anchor holes in kiva floors. Warping blocks.	Haury & Hargrave, 1931: 107–115. Smiley, 1951.
Kuaua	11	P IV	Loom anchor holes in kiva floor. Murals with textile representations.	Smith, 1952*b*: 76, 150–151. Tichy, 1938. Wendorf, 1953*b*.

CHART 1—*Continued*

Site	No. on Map	Culture Per. and/or Dates	Finds	Sources
Laguna Creek "Cornfields"	23	P III?	Loom anchor holes pecked in sandstone cliffs a few yards from the ruin.	Kidder & Guernsey, 1919: 70, fig. 26.
Lake Canyon	18	P III?	Plain weave blanket; plain weave sash with weft stripes at center; tie-dye blanket.	UM.
Las Acequias	60	Classic 1100–1400	Specialized pottery whorls. Plain weave cotton.	Haury, 1945*a*: 13, 166, 172.
Lenaki, Tsegi Canyon	34	P III 1124–1129	Irregular twill or weft-float.	MNA. Smiley, 1951.
Little Kiet Siel, Nitsie Canyon	39	P III?	Plain weave, painted.	ASM.
Los Guanacos	61	Col.-Sed. (some Classic) 700–1100	Specialized pottery whorls. Plain weave; broken twill plaid.	Haury, 1945*a*: 13, 176, 178–179.
Los Muertos	63	Classic 1100–1400	Cotton fiber. Specialized pottery whorls. Plain weave. Shell needles.	Haury, 1945*a*: 13, 115–121, 147–148, 163.
Marsh Pass, Cliff House #8	33	P III?	Loom anchor holes in kiva floor. Slabs incised with textile designs. Weaving tools? Plain weave; Anasazi twill.	PM. Kidder & Guernsey, 1919: 56–61.
McEuen Cave	81	?	Pot rest bound with cotton cord. String and cord. Plain weave; plain weave bag; mummy wrapped in plain weave cloth; nets; closed loop bags of hair cord and cotton rag strips.	ASM. Kelly mss., n.d.
Medicine Cave NA 863	50	P II 900–1050	Ball of cotton twine.	Bartlett, 1934. Smiley, 1951.
Mesa Verde	16	P III	Belt loom anchor loops in kiva walls. Loom anchor holes in floor. Spindle with wooden disk whorl. Plain weave; plain weave bags; painted plain weave; Anasazi twill; weft-twine tump lines and narrow bands; twill tapestry; rag-weft?	CSHS. CU. USNM. Fewkes, 1909. Nordenskiöld, 1893. Smiley, 1951. Watson, corresp., 1954.
Moapa Valley	—	P II–III	Fabrics (techniques not described).	Harrington, Hayden and Schellbach, 1930: 20, 75.
Mogollon Cr. Cave	88	BM or P ?	Cotton string.	Cosgrove, 1947: 13
Montezuma Castle	58	P III–IV (mostly IV)	Plain weave; plain weave painted; plain weave tapestry tie and tump line; rag-weft; warp-face tie; weft-float fragment and bag; diamond twill tapestry; weft-wrap; gauze; wrapped cord; fringed skirt or apron; braid, flat o-3 u-3.	AMNH. NPS-MC. Kent, 1954.
Monument Valley, Ruin #4	42	P III	Plain weave; cotton rag strip sandal tie.	PM. Kidder & Guernsey, 1919: 36–40.
Mule Creek Cave	83	P III?	Cotton cordage; plain weave; plain weave quiver-shaped article; weft-wrap; braids—flat o-2 u-2 and o-3 u-3; twine-plaiting; string skirt; looping over foundation cords or wrapped plaiting.	PM. Cosgrove, 1947: 29–30, 74–79.

CHART 1—*Continued*

Site	No. on Map	Culture Per. and/or Dates	Finds	Sources
Mummy Cave	30	P III 1253–1284	Plain weave; plain weave cradle band; twill tapestry; braid, flat o-2 u-2.	AMNH. CU. Smiley, 1951.
Navaho National Monument	37	P III?	Plain weave; twill; twine- and running-stitch embroidery; braid, flat o-2 u-2; closed loop bags.	USNM.
Nitsie Canyon	39	P III?	Wood whorls, disk and tubular. Plain weave; running-stitch embroidery.	ASM.
Northern Arizona	—	?	Braids, flat o-2 u-2; flat braid used as cradle band; plain weave tapestry band; plain weave tapestry crescent; fringed apron or skirt; tie-dye.	AMNH. ASM. PM. USNM. Haury, 1934. Kidder & Guernsey, 1919.
Oak Creek Canyon	57	P III–IV?	Plain weave; mummy of child wrapped in plain weave cloth.	ASM. MNA.
Obelisk Cave	26	BM II	No cotton. Braided dog hair sashes.	Amsden, 1949: pl. 3.
Olberg, cave near	—	P IV?	Plain weave and embroidered cigaret "sashes."	Private collections.
Olla House (Cliff House #7, Laguna Creek)	23	P III?	Loom anchor holes in kiva floor. Plain weave; plain weave bag; braid, flat, o-2 u-2 changing to square braid with cotton string "ball" on end.	PM. Kidder & Guernsey, 1919: 47–54.
Paa-ko	10	P IV	Loom anchor holes in kiva floors.	Tichy, 1938.
Painted Cave	29	P III 1247	Cotton seed with fiber. Loom anchor holes in room. Prayer feathers tied with cotton string; plain weave; plain weave blankets and poncho, painted; Anasazi twill; fringed apron; wool braid.	AF. Haury, 1945*b*.
Palatki	56	P IV	Plain weave; plain weave tapestry cradle band; rag-weft.	USNM. Fewkes, 1896.
Pecos (LA 625)	8	P IV–V	Loom anchor holes in kiva floor. Bone battens, eyed needles, disk whorls, weaving comb. Bead whorl probably from Mexico. Plain weave; gauze?; pile cloth of yucca fiber on cotton net?	Amsden, 1949. Kidder, 1932. Wendorf, 1953*b*.
Pinedale	76	P III–IV 1085–1375	Loom anchor holes in kiva floors. Warping blocks.	Haury & Hargrave, 1931: 52–53. Smiley, 1951.
Poncho House	19	P III	Loom anchor holes in kiva floors. Small batten? Plain weave; plain weave shirt, 4-piece, with sleeves, painted; twine-stitch embroidery; braid, flat o-2 u-2.	AMNH. PM. Guernsey, 1931: 45–53.
Poshu (LA 274)	1	P IV 1370–1420	Loom anchor holes in room. Bone needles with notches at end. Potsherd whorls?	Jeançon, 1923. Smiley, 1951. Smiley *et. al.*, 1953.
Puaray	12	P IV–V	Loom anchor holes in kiva floor. Cotton fiber. Dead wrapped in finely-woven fabrics.	Jones, 1936: 54. Tichy, 1939: 150. Vivian, 1934. Wendorf, 1953*b*.

CHART 1—*Continued*

Site	No. on Map	Culture Per. and/or Dates	Finds	Sources
Pueblo Bonito	14	P II–IIIa	Disk whorls of squash rind. Short loom end sticks. Small battens? Cotton cord. Plain weave; plain weave tapestry tump line; Anasazi twill; braid, square; and several unexplained techniques. (Possibly also well woven fiber cloth.)	AMNH. Amsden, 1949: 23. Pepper, 1920. Smiley, 1951.
Puyé	3	P IV 1507–1561	Loom anchor holes in kiva floor. Plain weave white and black cloth.	NMSM. Hewett, 1909*a*. Smiley, 1951.
Roger's Canyon, Cliff Dwelling	71	P IV?	Cotton boll, seeds and fiber.	MNA.
San Francisco Mountain area	—	P II	Cotton fiber, no seed. Thread. Plain weave.	MNA. Bartlett, 1934: 46–47.
Sapillo Creek, Cliff Ruin #7	90	P III	Cordage. Plain weave cloth; square braid	PM. Cosgrove, 1947: 16.
Sayodneechee, Monument Valley, Cliff House #2	42	P III	Plain weave.	PM. Guernsey & Kidder, 1921: 2, 24–30. Kidder & Guernsey, 1919: 19–24.
Showlow	74	P III–IV 1151–1382	Warping block.	Haury & Hargrave, 1931: 23.
Sipe Canyon Cave #5	84	P III	Cordage. Plain weave.	PM. Cosgrove, 1947: 28.
Snaketown	64	900–1100	Weft-wrap.	Gladwin *et al.*, 1937: 161–162.
Solomonsville, cave near	—	?	Gauze.	Hough, 1914: 80.
Southeastern Utah	—	?	Plain weave.	UM.
Southern Arizona	—	?	Plain weave; plain weave cigaret "sashes."	USNM. Hough, 1914: 107–111.
Southwestern Colorado	—	?	Plain weave bag with medicine pouches; plain weave knife bag; twill knife bag; Anasazi twill, with diamond weave; twill tapestry; crescent-shaped yucca fiber cloth stitched with cotton.	UM.
Sunflower Cave, Marsh Pass	33	P III	Plain weave; braid, flat o-2 u-2; cylindrical twill sacks.	PM. Guernsey & Kidder, 1921: 3–7. Kidder & Guernsey, 1919: 92–96; 114; 147–152.
Te'ewi	2	P III–IV 1250–1500	Loom anchor holes in kiva floors. Cotton thread on spindle shaft. Cordage. Plain weave.	Smiley *et. al.*, 1953. Wendorf, 1953*b*.
Terrace House Ruin, Tsegi Canyon	34	P III?	Plain weave.	ASM.

CHART 1—*Continued*

Site	No. on Map	Culture Per. and/or Dates	Finds	Sources
Tonto	72	P IV (Upper Ruin, 1346)	Fiber and seed. Plain weave; plain weave blanket; plain weave breech cloth; plaid; plain weave, paired wefts; eccentric plain weave; warp-face belting; warp-float pattern weave; embroidery; plain weave tapestry tie and tump line; twill tapestry; twill; twine-plaited shirt; rag-weft; cylindrical twill sacks; weft-wrap; gauze; braid, flat o-3 u-3, square, and around a core; fringed skirt; counter-paired warp-twine; gauze sash.	ASM. NPS-T. Haury, 1934: 97, pl. LX*b*. Kent, 1949. Steen, 1935 and 1941.
Tsegi Canyon	34	P III?	Plain weave; braid, flat o-2 u-2.	ASM. MNA.
Tsegi Canyon, Cave #1, Middle Branch, Grave 1, Burial 2	34	P I	Plain weave, checked; plain weave blankets and sleevelike object; plain weave tapestry tump line, some hair warps.	PM. Guernsey, 1931: 2–11, 97–98.
Tsegi Canyon, Cave #1, Room n	—	BM III	Cross bar spindles.	Guernsey, 1931: 82–83.
Tsegi Canyon, Cave 2	34	P III	Loom anchor holes in kiva floors.	Guernsey, 1931: 60–64.
Tsegi-ot-sosi, Monument Valley, Cave #8	41	BM & P III	Plain weave; weft-twine band, cotton wefts.	PM. Cummings, 1910: 10. Guernsey & Kidder, 1921: 34.
Tseh So, Chaco Canyon	13	P II	Loom anchor holes in kiva floor?	Brand *et al.*, 1937: 78.
Tucson Mountains	—	?	Plain weave.	ASM.
Tularosa Cave	87	300 B.C.–1200	Pre-pottery (150 B.C.)—thread. Pine Lawn—thread. Georgetown—cloth impressed sherd; netting; spindle shafts and pottery whorls. San Francisco (700–900)—pottery whorls, thread, plain weave. P III.—thread; plain weave in white, red and black; diamond twill tapestry; yucca needles; cord-wrapped cane cigarets. Unknown dates: plain weave; cotton skein clout; cordage.	USNM. Hough, 1914. Martin *et al.*, 1952.
Turkey Cave, Tsegi Canyon	34	BM through P III	Plain weave.	MNA. Guernsey, 1931: 57–70. Hargrave, 1935.
Twin Caves, Tsegi Canyon	34	P III 1102–1289	Cordage.	MNA. Smiley, 1951.
Two Mummy Ruin, Nitsie Canyon	39	P III?	Closed loop shoe-sock, cotton-and-wool.	ASM.
Tyuonyi	4	P IV 1417–1505	Loom anchor holes in kiva floors.	Hendron, 1940. Hewett, 1909*b*. Smiley, 1951. Smiley *et. al.*, 1953.
Unknown source	—	—	Plain weave; plain weave blanket; plain weave breech cloths; plain weave, heavy decorative wefts; plain weave tapestry band; fringed apron; diamond twill.	ASM. MNA. USNM. Cummings, 1915: 6.
Unshagi	6	P IV–V 1325–1604	Loom anchor holes in kiva floors.	NMSM. Reiter, 1938.

CHART 1—*Continued*

Site	No. on Map	Culture Per. and/or Dates	Finds	Sources
Upper Gila	—	?	Embroidery?	Amsden, 1949: 117.
Vandal Cave	27	BM III & P III?	Plain weave blankets wrapped about mummies.	ASM.
Ventana Cave	68	1000–1400	Yucca spine needle with eye. Plain weave; plain weave, paired warps; plain weave checked; weft-wrap; gauze; child's poncho; plain weave blankets; warp-face belting and tie; braid, flat o-2 u-2; rag strip clout; string clouts.	ASM. Haury *et al.*, 1950: 446–459.
Verde Valley	—	P III–IV?	Warp-face tie; plain weave. Brocaded bag.	AMNH.
Verde Valley Salt Mine	—	P III–IV?	Brocade; gauze; weft-wrap; plaid.	AMNH. ASM. Haury, 1934: 97. Morris, 1928.
Walnut Canyon	53	P II P III 911–1256	String (P II). Plain weave; plain weave breech cloth; warp-face belting; embroidery (P III).	MNA. Smiley, 1951.
Waterfall Ruin (Chinlee, Cliff House #9)	21	BM III through P III	Loom anchor holes in kiva floor. Loom "weights"? Plain weave; tie-dye; Anasazi twill.	PM. Guernsey, 1931: 32–36. Kidder & Guernsey, 1919: 71–74, 125.
White Dog Cave	32	BM	No cotton. Plain weave apocynum fiber cloth, warp-face, painted.	Guernsey & Kidder, 1921: 77. Kidder & Guernsey, 1919: 173.
White House	31	P III 1058–1275	Plain weave; plain weave, painted; tie-dye; plain weave with heavy decorative wefts; plain weave tapestry band; twine- and running-stitch embroidery; breech cloths—plain weave, twill, brocaded weft-float; weft-float pattern weave; Anasazi twill; twill tapestry; weft-wrap; braid—flat o-2 u-2, complete shirt, sling braided around core; closed loop, cotton-and-wool; fringed apron.	AMNH. BM. NMSM. Private collection. Smiley, 1951.
Winchester Cave	70	1100–1400?	Paired potsherd disks bound with string; prayer sticks, string-wrapped; balls of string, green, red, yellow, blue.	AF. Fulton, 1941.
Wupatki	52	P III 1070–1205	Plain weave; plain weave breech cloth; plain weave plus twill; tie-dye; plain weave tapestry tump line; twill; twilled cigaret "sash"; warp-face tie, black; weft-wrap; twill tapestry.	MNA. Smiley, 1951.
Zele Cave	29	P III?	Plain weave; plain weave bag; Anasazi twill.	ASM.

C. CHARTS 2–23. A CATALOGUE OF SPECIMENS DISCUSSED IN THE TEXT

KEY TO UNFAMILIAR TERMS AND ABBREVIATIONS USED ON THE CHARTS

Ana. stripe. Anasazi stripe twill pattern.

Bl. Black.

Blu. Blue.

Br. Brown.

Com. Complete.

D. Dark.

Dia. Diamond.

Diag. Diagonal.

Diam. Diameter.

Fragment. If the piece is very small and has no selvages the dimensions may not be given, and the term "fragment" appears instead.

Inc. Incomplete.

Irreg. Irregular.

L. Light.

M. Material.

Natural. In chart 2 the term "natural" is used for any undyed cloth which was presumably originally white.

R. Red.

Rev. Reversed.

S. Selvage. The number and make-up of the threads twisted along warp or weft edge is given. Thus "2 3-ply threads" means the selvage is composed of two threads, each three-ply. When only the number of plies is stated, it is understood there are just two selvage threads.

Squ. Square count.

Thr (s). Thread or threads.

TC. Thread count. The number of warps or wefts to the inch.

w. Weft.

W. Warp.

w.s. Weft stretch. The length of the cloth measured with the rule laid parallel to the wefts. All measurements are understood to be in inches.

W.s. Warp stretch. The length of the cloth measured with the rule laid parallel to the warps.

Wh. White.

Wool. Unidentified animal hair or wool.

Y. Yellow.

2/1, 2/2, 1/2, 3/1, 3/3. These figures stand for twill rhythms. For example, 2/1 means that the wefts are floated over two warps, under one warp.

When a specimen appears on more than one chart, this is indicated in the column headed "Description."

CHART 2, a

PLAIN WEAVE, SINGLE-PLY WARP AND WEFT

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
AMNH no numbers	Fragment		27	24	Natural		2 4-ply threads	One raw weft edge overcast with double thread.		Verde Valley	? P III–IV
	10 Fragments		ave. 27	ave. 24	"					Poncho House & Lower Chinlee Valley	? P III
	2 Fragments		"	"	Black dye					"	"
	9 Fragments				Natural			Stained yellow or gray.		"	"
	42 Fragments				"			Stained. Worn.		Canyon de Chelly	P III
AMNH H/3149	2 Fragments		31	17	"	2 6-ply threads		2 pieces sewed together with fiber string. Saddler's stitch.		Pueblo Bonito	P II–IIIa
AMNH H/3150	Fragment		20	23	"	2 3-ply threads	2 3-ply threads			"	"
AMNH H/10632	"		33	29	"			Edge folded and hemmed. Patch.		"	"
AMNH H/13237	"		29	27	"					Grand Gulch or Kayenta	? P III
AMNH H/13289	"		"	"	"					"	"
AMNH H/13386	6 Fragments		"	"	"					Poncho House & Lower Chinlee Valley	"
AMNH H/13753	Fragment				"					Grand Gulch or Kayenta	"
AMNH H/14329	"				Black dye					"	"
AMNH H/14565	"		37	34	Natural	2 3-ply threads		One edge folded and sewed.		"	"
AMNH H/14661	"				"	2 2-ply threads				"	"
AMNH H/15736	"		27	24	"			One edge folded and sewed.		"	"
AMNH 14/220	"		22	27	"					Verde Valley	? P III–IV
AMNH 14/221	"		27	22	"			Raw weft edge rolled & whipped.		"	"
AMNH 14/222	"		18	21	Red dye					"	"
AMNH 14/224	"				"					"	"
	"				"	2 3-ply threads				"	"
	"					2 3-ply threads	2 3-ply threads			"	"
	"		38	32	Brownish-red	"	"			"	"
	"				Red-orange dye			Running-stitch darn.		"	"
	"				"	2 2-ply threads	2 2-ply threads			"	"
AMNH 14/298	"		34	32	Natural					"	"
AMNH 29.0/8962	Inc. 11	Inc. 6¾	23	28	"	2 2-ply threads	2 2-ply threads	One warp edge and one weft edge are raw, no selvages. These edges are folded and sewed down.		Aztec	P III
AMNH 29.1/7619A	Fragment				"					White House	"
AMNH 29.1/7645	"		30	26	"					"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
AMNH 29.1/7653	Fragment				Natural			May have been painted.		White House	P III
AMNH 29.1/7664	"				Orange tinge					"	"
AMNH 29.1/7708	"				Natural					"	"
AMNH 29.1/7709	6 Fragments				"					"	"
AMNH 29.1/7744	Fragment		27	24	"			Patched.		"	"
AMNH 29.1/7893	10 Fragments				"			Stained gray or yellow.		"	"
AMNH 29.1/7989	Fragment				Red dye					"	"
	"				Yellow-brown dye					"	"
	4 Fragments				Natural			Stained brown or yellow.		"	"
AMNH 29.1/7933	Fragment				"					"	"
ASM 490	"		36	28	"					Tsegi Canyon	? P III
ASM 493	"				"	2 3-ply threads—row twine-stitching 2 wefts in.				"	"
ASM 1098	"		20	22	"			Twine- and running-stitch darning.		Chilchintaboko Nitsie Canyon	? P III
ASM 1100	"		22	22	"			Twine-stitching and patching.		Unknown	?
ASM 1110	"		22	22	"			Seaming up two vertical tears with twine-stitches.	p. 576 f. 89; 90, G	Chilchintaboko Nitsie Canyon	? P III
ASM 1115	"		22	22	"			Darned and patched.		Tsegi Canyon	? P III
ASM 1116	"		22	24	"			Twine-stitching.		Cave Town Ruin, Nitsie Canyon	? P III
ASM 1134	"				Brown—may be dye		2 3-ply threads	Seamed.		Terrace House Ruin, Tsegi Canyon	? P III
ASM 1150	"		24	22	Brown—probably stained			Darned.		Eagle's Nest Ruin, Tsegi Canyon	"
ASM 1151	"		20	20	"			Two narrow strips sewed together.		Terrace House Ruin, Tsegi Canyon	"
ASM 1831	"		28	22	Blackish—probably stained					Betatakin, Room 38	P III
ASM 2600?	"		26	18	Brownish-black—probably stained					Unknown	?
ASM 2787	"		24	20	Natural			Raw weft edge rolled and overcast.		Gourd Cave	P III
ASM 2787b	"		24	20	"			Patching. Twine-stitching. Some running stitches in very thick 2-ply cotton. Stitches make 0–3 U-3 twill design.	p. 575 f. 90, C	"	"
ASM 2787c			20	26	"			Twine-stitching. Running stitches in rows 2 wefts apart. 0–3 U-3 warps. Twill effect.		"	"
ASM 2787d	"		22	18	"			Twine-stitching.		"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
ASM 2787e(a?)	Fragment		22	22	Natural			Twine-stitching. Some running-stitch darning.		Gourd Cave	P III
ASM 2932	"		28	24	Brown dye			Rows twine-stitching in 2-ply white thread over worn part of cloth.		Gourd Cave & other caves, Nitsie Canyon	? P III
ASM 2933	2 Fragments		26	32	Natural					"	"
ASM 2933?	Fragment		20	26	"			Twine-stitching.		Gourd Cave	P III
ASM 2937	"		46	28	Brown dye			Fine weave.		Gourd Cave & other caves, Nitsie Canyon	? P III
ASM 2938	"		24	24	Natural	2 2-ply threads. Selvage and 3 edge wefts overcast in close vertical stitch with heavy 4-ply cord.			p. 577 f. 94, C	"	"
ASM 2987	"		26	24	"			Raw weft edge rolled and overcast.		Gourd Cave	P III
ASM 2988	"		26	22	"			Warp and weft edge overcast with 2-ply thread.		"	"
ASM 2992	Narrow strip of warp selvage		22	24	" (pink tinge)	2 3-ply threads				"	"
ASM 2993	Fragment		40	24	"		2 3-ply threads	Raw warp edge overcast.		"	"
ASM 2995	"		22	21	"			Twine-stitching.		"	"
ASM 2996	"		28	22	"		2 2-ply threads			"	"
ASM 3012	"		20	28	"		2 3-ply threads	Parallel rows twine-stitching. 2-ply threads.		Gourd Cave & other caves, Nitsie Canyon	? P III
ASM 3014	Inc. 4½	Inc. 2½ folded on self	24	22	"			Piece folded on self. Selvage edge overcast to raw edge.		Gourd Cave & other caves, Nitsie Canyon	"
ASM 3022	Fragment		22	26	"			Patched.		"	"
ASM 3022a	"		22	22	"			Raw warp edge rolled and overcast.		"	"
ASM 3022b	"		22	26	"					"	"
ASM 3022c	"		22	22	"			Raw weft edge rolled and overcast. Patched.		"	"
ASM 3022d	"		24	24	"	2 3-ply threads 2-ply thread whipped over 3 wefts just below selvage.		Patched.		"	"
ASM 3022e	"		24	24	"			Patched.		"	"
ASM 3022f	"		28	20			2 3-ply threads. Row twine-stitches in fine 3-ply thread one warp from edge.			"	"
ASM 3022g	"		22	20	"			Patched. Twine-stitching.		Gourd Cave	P III
ASM 3022h	"		24	22	"			Two rolled, overcast edges sewed together with double thread, overcast stitch.		"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
ASM 3022i	Fragment		22	26	Natural			Raw warp edge overcast. Row twine-stitching below this.	p. 576 f. 91, G	Gourd Cave	P III
ASM 3022j	"		22	24	"			Raw warp edge rolled and overcast.		"	"
ASM 3022k	4 Fragments		22	22	"					"	"
ASM 30221	Fragment of warp selvage				"	2 3-ply threads				"	"
ASM 3022m	Fragment		24	24	"			Raw weft edges rolled and overcast. Twine-stitching.		"	"
ASM 3022n	"		26	22	"			Running-stitches. 3-ply thread.		"	"
ASM 3022o	"		22	22	"			Raw warp edge finished by row twine-stitching and overcast on top of that.	p. 576 f. 91, H	"	"
ASM 3022p	"				"			Darned, twine-stitching.		"	"
ASM 3022q	23 Fragments		Average 24	22	"					"	"
ASM 3023	Fragment		21	21	"					Gourd Cave & other caves, Nitsie Canyon	? P III
ASM "	"		26	20	"					"	"
ASM "	"		22	22	"					"	"
ASM "	"		28	20	"					"	"
ASM "	"		28	22	"					"	"
ASM "	"		22	20	"			Long strip, pieced. Some overcasting—2-ply sewing thread.		"	"
ASM "	"		24	18	"					"	"
ASM "	"		26	20	"					"	"
ASM "	"		24	24	"					"	"
ASM "	"		22	24	"					"	"
ASM "	"		22	26	"					"	"
ASM "	"		22	20	"			Twine-stitching. Patch. 2-ply thread.		"	"
ASM "	"		20	22	"			Patch sewed with twine-stitching 2-ply thread.	p. 575 f. 90, K	"	"
ASM "	"				"			Patch sewed on with double 2-ply thread. Rolled edge overcast. Row twined-stitching along inner edge of fold. Neat rows twine-stitching 2 warps wide.	p. 576 f. 90, K; 91, I	"	"
ASM "	Long narrow strips		26	26						"	"
ASM "	Fragment		24	24	Natural			Patch sewed on with overcast stitch. Some twine-stitching. 2-ply sewing threads.	p. 575 f. 90, J	"	"
ASM "	"		32	24	"			Rows twine-stitching. 2-ply thread.		"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
ASM "	Fragment		24	22	Natural					Gourd Cave & other caves, Nitsie Canyon	? P III
ASM "	"		24	20	"			Edges overcast. 2-ply thread.		"	"
ASM "	"		22	28	"					"	"
ASM "	"		28	20	"					"	"
ASM "	"		24	22	"						
ASM "	"		28	26	"					"	"
ASM "	"		26	24	"			Twine-stitching. 2-ply thread.		"	"
ASM "	"		22	20	"			Patch.		"	"
ASM "	"		24	18	"					"	"
ASM "	"		24	22	"			Twine-stitching. 2-ply thread.		"	"
ASM "	"		24	22	"					"	"
ASM "	"		22	24	"			Patched. Twine-stitching, 2-ply thread.		"	"
ASM "	"		22	20	"			Patched with overcast stitch. 2-ply thread.		"	"
ASM "	"		30	26	"					"	"
ASM "	"		22	28	"	2 4-ply threads				"	"
ASM "	"		25	22	"		2 3-ply threads	Patched. Twine-stitches, 2-ply thread.		"	"
ASM "	"		20	26	"			Patched. Two edges rolled and overcast. 2-ply thread.		"	"
ASM "	"		24	24	"			Overcast warp edge. Twine- and running-stitching. 2-ply thread.		"	"
ASM 3213	"		26	22	Brownish dye or stain?					Tsegi Canyon	? P III
ASM 3455	"		28	26	Brownish-black dye					Gourd Cave & other caves, Nitsie Canyon	P III
ASM 16051	"		18	30	Reddish brown			Twine-stitch darning.		Gold Tooth Canyon	? P III
ASM 16052	"		20	22	Natural			Probably fragmentary manta.		"	"
ASM 16143	"		24	26	"					Zele Cave	"
ASM 19594	"		20	20	Blackish probably stain	2 3-ply threads				Tsegi Canyon	"
ASM 20505	"		23	18						Hidden House	P III
ASM 20992	"				Charred					Tucson Mts.	?
ASM 21686	"		24	26	Reddish-brown dye			Mummy wrappings of child.		Oak Creek Canyon	? P III–IV
ASM 25519	"		28	22	Brownish-red dye					Gourd Cave & other caves, Nitsie Canyon	? P III

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
ASM 25520	Inc. 3	Inc. 26	20	20	Natural	2 5-ply threads		Rows twine-stitching parallel wefts. ¾″ apart. Stitches 3 warps wide. 2-ply thread.		Gourd Cave & other caves, Nitsie Canyon	? P III
ASM 25958, 25970, 25971, 25976, 25968, 25988	6 Fragments		*ca.* 22	*ca.* 20	"					No. Arizona	?
ASM 25969	Fragment				"					"	?
ASM 25980	"		24	20	Brown—probably stain					"	?
ASM 25986	"				Natural-yellowish stain		2 4-ply threads			"	?
ASM 25989	"		24	20	Brownish-black. Dye?					"	?
ASM 26005	"		22	18	Natural					"	?
ASM A67	"		28	22	Uneven red—probably dye	2 4-ply threads	2 4-ply threads			Oak Creek Canyon	? P III–IV
ASM–?V-6	"		52	48	Natural			Warp-face cloth.		Camp Verde	"
ASM–V.C. Upper test #1	4 Fragments		30 38 34 26	22 18 18 16	Natural	2 3-ply thread	2 3-ply thread	"		Ventana Cave	1000–1400
ASM–V.C. Upper test #1-1	Fragment		24	22	"			"		"	"
ASM–V.C. Upper test A-1	"		34	24	"			"		"	"
ASM–V.C. Upper B. 25–.50	2 Fragments		34	22	Brown dye			"		"	"
ASM–V.C. B. #9	12 Fragments		20	22	Natural			Darned with 2-ply orange thread, twine-stitch.	p. 574 f. 90, B	"	"
			28	20	"		2 4-ply thread	"		"	"
			32	18	"		"	Darned with 2-ply yucca cord, twine-stitch. Warp-face cloth.		" "	" "
			34	22	Red dye			Warp-face cloth.		"	"
			30	22	Natural			"		"	"
			32	22	"			"		"	"
			34	18	"			"		"	"
			40	24	"			"		"	"
			34	26	Brown dye?		2 3-ply thread	"		"	"
			28	18	Natural		2 4-ply thread	Darned with 2-ply orange thread, twine-stitch. Warp-face cloth.		"	"
			28	26	"			Warp-face cloth.		"	"
			36	22	"			"		"	"
ASM–V.C. B. #17	Fragment		34	24	"			Twine-stitching in 2-ply natural thread. Warp-face cloth.		"	"
ASM–V.C. B. #19	3 Fragments		30 34 30	18 24 18	Red dye Brown dye Natural			Warp-face cloth.		"	"
CSIIS–01446	Fragment		24	27	"			Warps fine; wefts thick and soft.		Mesa Verde	P III

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
CSHS-01447	Fragment		24	27	Natural	2 3-ply threads		Warps fine; wefts thick and soft.		Mesa Verde	P III
CSHS-01448	"				"			"		"	"
CSHS-01449	"				"			"		"	"
CSHS-01450	"		30	24	"			Even weave, thick wefts.		"	"
CSHS-01451	"		22	27	"		2 3-ply threads	Darned with yucca string. Patched.		"	"
CSHS-01452	"				"			Thick wefts.		"	"
CSHS-01453	"		27	24	"	2 2-ply threads		"		"	"
CSHS-01455	"		22	22	Brown dye?					"	"
CSHS-01456	"		22	22	"			Twine-stitching. Embroidery?		"	"
CSHS-01457	"		32	27	"					"	"
CSHS-01458	"				"					"	"
CSHS-01459	"		23	24	Yellow dye?	2 2-ply threads				"	"
CU-2664	"		25	25	Natural	2 2-ply threads	2 3-ply threads	Twine-stitching. Embroidery? Cloth attached to cedar bark ring, 3¼" in diam.		Canyon del Muerto	? P III
GP 17115	"		40	34	"	2 4-ply threads				Canyon Creek	P IV
GP 17126	"				"	"		Two cloths joined with "marline hitch," 3-ply sewing thread.	f. 92, A	"	"
MNA 77/387-K(a)4	"		23	23	Brown dye					Wupatki	P III
MNA 77/387-L(A)	"		22	22	Natural					"	"
MNA 77/387-L(B)	"		22	22	"			2-ply fiber cord drawn through cloth in large, running stitches.		"	"
MNA 77/387-L(C)	4 Fragments		22	22	Brown—probably dye			2-ply black cotton string drawn through 2 of pieces in running stitch.		"	"
MNA 77/387-L(D)	2 Fragments Inc.	Com.? ¾	12 per ½"	24	Natural		May have 3-thread selvages	2 long pieces knotted together. The width may be complete—there appear to be weft selvages.		"	"
MNA 77/387-L(E)	2 Fragments (1) (2)		19–21 21	19–21 28	"			Warps—very coarse. Have fiber twisted in with cotton.		"	"
MNA 77/387-L(F) 1. 2. 3.	Fragment " "		16 22 30	14–16 16 17	Stained yellow		 2 2-ply threads	Warps fine, widely spaced. Wefts very thick, close together.		"	"
MNA 77/387-L(G) 1. 2.	" "		22 18	17 18	Brown dye? Brown dye?		2 3-ply threads	Two rows running stitches across fragment—probably darning.		"	"
MNA 77/387-L(H)	Inc. 13 1/16	Com. ? 6⅛	24	18	Natural		2-ply threads. Remains of both weft selvages.	This piece may be part of a breech cloth.		"	"
MNA 77/NA405.M228	Fragment		32	29	Red dye					"	"
MNA 77/NA405.M229	"		18	20	Natural			Parallel to wefts are several rows of running stitches, ¼" apart—probably darning.		"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
MNA 77/NA405.M230	Fragment		23	19	Natural			Parallel to wefts are several rows of running stitches ¼"–½" apart. These appear to "shirr" material. Probably darning.		Wupatki	P III
MNA 77/NA405.M231	"		28	20	Blue-gray dye			Darn over worn spot. Running stitches about ¼" long, in brown dyed cotton.	p. 574	"	"
MNA 259/1128–1128A–1128B–1129–1130	Fragments		20 25 37	19 30 36	Natural			Cloths of different textures sewed together. Mummy wrappings. Worn, patched & darned scraps.	p. 575 f. 90, E	Lower Oak Creek	P III–IV?
MNA 273/1223C	Fragment		25	21	"			Piece of cloth covered with verdigris. Preserved by contact with copper bracelet on child's arm in burial.		Deadman's Drainage N.A. 998	P II
MNA 561/739.10	"		24	21	"					Walnut Canyon	P III
MNA 621/NA405.M24	"		21	16	Natural—some patches of red color.			Parallel to wefts are rows of running stitches ¾" apart. Stitches ¾" long. Hold loose bundles of threads against cloth. These may represent remains of a patch.		Wupatki	"
MNA 621/NA405.R35A.1	2 Fragments		29	29	Natural					"	"
MNA 621/NA405.R35A.12	Fragment		22	21	Brown dye					"	"
MNA 621/NA405R35A.13	"		24	24	Natural			9 rows running stitches, ¼" apart and parallel to wefts near one end of piece.		"	"
MNA 627/405.M224(A)	"		24	18	"					"	"
MNA 692/A.50	"		Average		Red-brown dye			Found with infant mummy wrappings.		Mouth of Oak Creek at junction. with Verde R.	P III–IV ?
MNA 693/405R7.2	"		20	18	Red—probably dye					Wupatki	P III
MNA 693/405R7.6	2 Fragments		53	53	Red dye			Exceptionally fine, even weave.		"	"
MNA 693/405R41.2	"		21	18	Brownish tan Probably dye					"	"
MNA 695/NA2519.13	Fragment		Average (*ca.* 24-22)		Coated black—probably pitch			Very even weave. Almost a tapestry.		Kiet Siel	"
MNA 695/NA2519.38	"		"		Natural			Twined darning. Patched.		"	"
MNA 695/NA2519.M46	2 large fragments		"		"			Twined darning on one cloth. Two are patched together.		"	"
MNA 695/NA2519.48	Inc.	4½"	"		"		2 3-ply threads	Two pieces patched together. Fringe made by twisting unwoven warps together at one point. Doubtful whether this is intentional or not. Twined darning along one warp edge.		"	"
MNA 695/NA2519.120	Fragment		"		"					"	"
MNA 695/NA2519.176	"		25	20	"	2 2-ply threads. Extra string over these.		Row twining one weft pick in from warp selvage, 2-ply thread.	p. 578 f. 94, E	"	"
MNA 695/NA2519.191A 191B 191C	"		Average (*ca.* 24-22)		"			Patched and darned cloth. Darning stitches are long running stitches.		"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
MNA 695/NA2519.M229a	Fragment		Average (*ca.* 22-24)		Natural					Kiet Siel	P III
MNA 695/NA2519.M251a	"		"		"					"	"
MNA 695/NA2519.M252a	"		"		"			Patched and darned.		"	"
MNA 695/NA2519.M253a	"		"		"	2 3-ply threads				"	"
MNA 695/NA2519.M257	"		"		"	2 3-ply threads	2 3-ply threads	Selvage threads meet at corner and twist into tassel.		"	"
MNA 695/NA2519.M258	"		"		Blackish brown —may be dye					"	"
MNA 695/NA2519.M261	"		"		Natural					"	"
MNA 695/NA2519.M262	"		"		"		2 3-ply threads			"	"
MNA 695/NA2519.M263	"		"		"		2 2-ply threads			"	"
MNA 695/NA2519.M264	"		"		"					"	"
MNA 695/NA2519.M266, M267, M268, M269, M270, M271	6 Fragments		"		"					"	"
MNA 695/NA2519.M272	Fragment		"		"		2 3-ply threads	Row of large running stitches next to the selvage threads; probably they once fastened 2 cloths together.		"	"
MNA 695/NA2519.M273	"		"		"			Tear parallel to warps. Turned in and overcast.		"	"
MNA 695/NA2519.M274	"		"		"			Tear parallel to warps. Turned in and overcast.		"	"
MNA 695/NA2519.M275	"		"		"	2 2-ply threads. Row twining below selvage.				"	"
MNA 695/NA2519.M276	"		"		"			Raw weft edge overcast with 2 strings.	p. 575 f. 91, B	"	"
MNA 695/NA2519.M277	"		"		"			Threads twined along warp edge with stitches 4 warps wide. Maybe remains of warp selvage.		"	"
MNA 695/NA2519.M278	"		"		"	2 2-ply threads	2 3-ply threads	Warp and weft selvages meet at corner and twist into a knot or tassel.			
MNA 695/NA2519.M279	"		"		"			Raw weft edge rolled and overcast.		"	"
MNA 695/NA2519.M280	"		"		"					"	"
MNA 695/NA2519.M281	"		"		"	2 2-ply threads. Row overcasting one weft pick in from this.			p. 577 f. 93, K	"	"
MNA 695/NA2519.M282	"		"		"	2 3-ply threads. Row overcasting just below this.			p. 577 f. 93, J	"	"
MNA 695/NA2519, M283, M284, M285, M286, M287, M288, M289, M290, M291, M292, M293, M294	10 Fragments		"		"					"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
MNA 695/NA2519.M296, M297, M298	3 Fragments		Average (*ca.* 24-22)		Natural					Kiet Siel	P III
MNA 695/NA2519.M299	Fragment		"		"			Some twined darning.		"	"
MNA 695/NA2519.M300, M301, M302, M303, M304, M305, M306, M307, M308, M309	10 Fragments		"		"					"	"
MNA 695/NA2519.M310	Fragment		"		"			Patched.		"	"
MNA 695/NA2519.M311, M312, M313	3 Fragments		"		"					"	"
MNA 695/NA2519.M314	Fragment		"		"			2 pieces held together by running stitches.	f. 92, E	"	"
MNA 695/NA2519.M315	"		"		"			Raw weft edge, overcast. Patch.		"	"
MNA 695/NA2519.M316, M317	"		"		"			2 pieces patched together. One mended with twined darning.		"	"
MNA 695/NA2519.M318	"		"		"					"	"
MNA 695/NA2519.M319	"		"		"			Patched.		"	"
MNA 695/NA2519.M320	"		"		"			Running stitches in 2-ply thread.		"	"
MNA 695/NA2519.M321	"		"		"					"	"
MNA 695/NA2519.M322	"		"		"			Patched.		"	"
MNA 695/NA2519.M323	"		"		"			Long, narrow strip. Twined darning in some places.		"	"
MNA 695/NA2519.M324, M325	"		"		"			Twined darning in soft, thick 2-ply thread. Patched.		"	"
MNA 695/NA2519.M326,M327, M328	3 Fragments		"		"					"	"
MNA 695/NA2519.M329	Fragment		"		"			Patched and darned.		"	"
MNA 695/NA2519.M330, M331, M332, M333	4 Fragments		"		"					"	"
MNA 695/NA2519.M334	Fragment		"		"			Twined darning used in embroidery manner.		"	"
MNA 695/NA2519.M338	"		"		"	2 2-ply threads. Row twining 5 weft picks in from selvage.				"	"
MNA 695/NA2519.M339	"		"		"					"	"
MNA 695/NA2519.M340	"		"		"	2 4-ply threads				"	"
MNA 695/NA2519.M341	"		"		"		2 2-ply threads			"	"
MNA 695/NA2519.M342, M343	2 Fragments		"		"			Long narrow pieces. Darned. Raw warp edges overcast.		"	"
MNA 695/NA2519.M344, M345	2 Fragments		"		"					"	"
MNA 695/NA2519.M350	Fragment		"		"		2 3-ply threads			"	"
MNA 695/NA2519.385	"		"		Yellow-brown. Probably charred		2 2-ply, fine threads	Very evenly woven.		"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
MNA 695/NA2519.422a, 422b, 422c	3 long, narrow strips		Average (*ca.* 24-22)		Natural	2 2-ply threads. Row twining just below these.				Kiet Siel	P III
MNA 695/NA2519.533	Fragment		"		"	2 3-ply threads. Row twining just below these.				"	"
MNA 695/NA2519.601	"		"		"	2 3-ply threads. Selvage overcast with fine 2-ply thread. Over this & two edge weft rows is tight vertical overcasting with 2-ply soft thread.			p. 577 f. 94, F	"	"
MNA 695/NA2519.713	"		"		"			Raw weft edge turned under and sewed.	p. 575 f. 91, D	"	"
MNA 695/NA2519.719	"		"		"					"	"
MNA 695/NA2519.723	"		"		"	2 3-ply threads. Row overcasting beneath them.				"	"
MNA 695/NA2519.778	"		"		"			2 pieces sewed together with 2-ply yellow thread.		"	"
MNA 695/NA2519.779, 780, 781, 782, 783	5 Fragments		"		"					"	"
MNA 909/NA2515.12	Fragment		25	20	"					Betatakin	"
MNA 909/NA2520.5b	2 Fragments		26	20	"					Turkey Cave, Tsegi	"
MNA 909/NA3533.4a	Fragment		Average		"					Betatakin	"
NMSM Bc 34/1	"		29	28	"	Warp and weft ends twisted together into selvage.			p. 576 f. 126, C	Chetro Ketl	P II–IIIa
NMSM 783–791	7 Fragments		28 35 26	25 24 21	Natural 1 dyed black					"	"
NMSM 1095	Fragment		20	18	Natural					Rito de los Frijoles	P IV
NMSM 3585	"		20	18	"					Puyé	"
NMSM 10145	2 Fragments		17 19	15 19	Natural Black dye					"	"
NMSM no numbers	Fragments		21	19	Natural 1 dyed black					Rito de los Frijoles	"
NMSM no numbers	3 large Fragments		19	16	Natural	2 2-ply threads	2 2-ply threads. Row twine-stitch inside this.			Chaco Canyon	P II–IIIa
NMSM no number	Fragment				Charred					Jemez Cave	P IV
NPS–MC 1	"		25	21	Natural					Montezuma Castle	P III–IV
NPS–MC 2	"		19	19	"					"	"
NPS–MC 3	"		21	19	"					"	"
NPS–MC 6	"		23	22	"					"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
NPS-MC 8	Fragment		22	20	Natural			Raw edge rolled and overcast.		Montezuma Castle	P III-IV
NPS-MC 9	"		25	24	Orange-red dye					"	"
NPS-MC 10	"		28	24	Natural					"	"
NPS-MC 14	"		23	22	"	4 selvage threads. Selvage overcast with 2-ply thread.			p. 577 f. 94, B	"	"
NPS-MC 15	"		27	27	"					"	"
NPS-MC 19	"		37	36	Orange-red dye					"	"
NPS-MC 21	"		28	23	Natural			Raw edge overcast with 4-strand sewing thread.		"	"
NPS-MC 55	"		30	23	"					"	"
NPS-T R16-1	"				Red paint?		2 3-ply threads	Evidence of patch sewed to cloth.		Tonto	P IV
NPS-T R16-2	"		24	24	"			Red marks on the surface may indicate cloth was painted.		"	"
NPS-T R16-3	"		24	24	Natural					"	"
NPS-T R16-4	"		22	22	"					"	"
NPS-T R16-5	"		32	40	"			Tight, even weave.		"	"
NPS-T R16-6	"		27	17	"			Weft edge rolled under $\frac{3}{16}$" and overcast with single-ply thread, stitches $\frac{1}{4}$" apart.		"	"
NPS-T R16-7	"		20	24	"			Coarse weave.		"	"
NPS-T R16-8	"				"	2 3-ply threads	2 4-ply threads			"	"
NPS-T R16-9	"				"		2 4-ply threads			"	"
NPS-T R16-10	"		27	22	Brown dye					"	"
NPS-T R16-11	"		32	32	"					"	"
NPS-T RD-A	"				Natural		2 3-ply threads			"	"
NPS-T 9/X	"				"					"	"
NPS-T 9/26	"		22	20	"	2 3-ply threads	2 3-ply threads	Selvage threads meet at corner. Extra string added to form rudimentary tassel.		"	"
NPS-T 9/27	"		17	22	"	2 4-ply threads				"	"
NPS-T 9/29	"		20	24	"					"	"
NPS-T 9/30	Fragment		20	20				Loose weave.		"	"
NPS-T 9/31	"				"			Running stitches used as darning, parallel both warps and wefts. Soft, thick single-ply thread.		"	"
NPS-T 9/32	"		24	20	"					"	"
NPS-T 9/35	"		24	22	"	2 3-ply threads, overcast		Selvage overcast with 2-ply loosely-twisted string. May have bound cloth to loom bar, or may be remains of a fringe.	p. 578 f. 94, I	"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
NPS–T 9/58	Fragment		27	20	Red dye					Tonto	P IV
NPS–T 9/59	"				Natural		1 3-ply and 1 4-ply	Two pieces cloth knotted together.		"	"
NPS–T 9/67	"				"		2 4-ply threads	Long narrow strip, knotted in several places.		"	"
NPS–T 9/72	"				Brown dye	2 5-ply threads				"	"
NPS–T 9/74	"				Natural					"	"
NPS–T 9/75	"				"					"	"
NPS–T 9/76	"				"					"	"
NPS–T 9/77	"				"					"	"
NPS–T 9/78	"				"					"	"
NPS–T 9/79	"				Brown dye			Uneven coloring.		"	"
NPS–T 9/80	"				Natural					"	"
NPS–T 9/82	"		17	22	"					"	"
NPS–T 9/83	"				"					"	"
NPS–T 9/84	"		20	24	"	2 3-ply threads				"	"
NPS–T 9/97	"		22	24	"					"	"
NPS–T 9/100	Fragment		22	19	"					"	"
NPS–T 9/101	"		37	24	"			Fine, even weave. Knotted near one end. One weft edge overcast, scarcely rolled at all.		"	"
NPS–T 9/102	Fragment				Yellow					"	"
NPS–T 9/103	"		17	20	Natural					"	"
NPS–T 9/104	"		15	15	"					"	"
NPS–T 9/105	"		22	22	"					"	"
NPS–T 9/106	"				"			Tear parallels warp. Torn edge rolled and overcast with 2-ply thread.		"	"
NPS–T 9/107	"		27	27	"			Rows running stitches paralleling wefts form darn over worn end.		"	"
NPS–T 9/108	"		17	17	"					"	"
NPS–T 9/109	"		32	30	"			Narrow strip knotted at one end to 9/582 and 9/414.		"	"
NPS–T 9/110	"		24	22	"					"	"
NPS–T 9/111	"		24	20	"					"	"
NPS–T 9/112	"		20	22	"			Narrow strip knotted at one end.		"	"
NPS–T 9/114	"		27	27	"					"	"
NPS–T 9/115	"				"					"	"
NPS–T 9/117	"				"	2 3-ply threads				"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
NPS–T 9/118	Fragment				Natural			Coarse weave.		Tonto	P IV
NPS–T 9/119	"				"					"	"
NPS–T 9/120	"				"			Long narrow strip. Wefts largely worn out.		"	"
NPS–T 9/121	"				"					"	"
NPS–T 9/127	"				Red dye					"	"
NPS–T 9/128	"				Natural					"	"
NPS–T 9/149	"				"					"	"
NPS–T 9/150	"		27	27	"					"	"
NPS–T 9/151	"		22	26–27	Yellow					"	"
NPS–T 9/152	Fragment				Natural					"	"
NPS–T 9/153	"		24	24	"					"	"
NPS–T 9/154	"		27	27	"					"	"
NPS–T 9/158	Fragment				"			2 small scraps joined at edges.		"	"
NPS–T 9/159	"		22	22	"					"	"
NPS–T 9/174	"				Brown dye	2 4-ply threads		Warp selvage fragment. 2-ply string run through cloth about ¼" from edge. Running stitches. Bits of black 2-ply string hooked through this.		"	"
NPS–T 9/184	"				Natural					"	"
NPS–T 9/205	"		27	27	"					"	"
NPS–T 9/216	Inc. 3¼"	Com. 12¼"			"	2 3-ply threads	2 3-ply threads	Cloth in form of bracelet. Top is warp selvage. 2 side selvages joined. Sewing thread is 2-ply brown string. Evidence of cotton thread fringe at top of selvage.		"	"
NPS–T 9/217	Fragment		24	22	"					"	"
NPS–T 9/219	"		27	20	"					"	"
NPS–T 9/220	"				"					"	"
NPS–T 9/222	"		32	27	"					"	"
NPS–T 9/223	"				Red dye					"	"
NPS–T 9/228	"		17	24	Natural					"	"
NPS–T 9/229	Fragment		27	27	"					"	"
NPS–T 9/230	"				"	2 4-ply threads				"	"
NPS–T 9/231	"		27	27	"					"	"
NPS–T 9/250	"		24	22	"					"	"
NPS–T 9/251	Fragment		32	30	"					"	"
NPS–T 9/264	"		27	24	"			Knotted near one corner. Untwined fiber (yucca?) wrapped around cloth near knot.		"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
NPS–T 9/267	Fragment		27	30	Natural					Tonto	P IV
NPS–T 9/268	"		30	22	"	2 4-ply threads		Tightly twisted warp selvage.		"	"
NPS–T 9/291	"		30	24	Red paint?			Lines and dots of red paint on cloth. Design probably painted on it.		"	"
NPS–T 9/292	"		54	27	Natural	Finished edge	2 1-ply threads	Finely woven. Extra threads hooked through corner of material, and weft threads extend beyond edge of cloth. Probably formed tassel.		"	"
NPS–T 9/293	Fragment		17	17	"			Wefts loosely spun and scarcely beaten down.		"	"
NPS–T 9/294	"		22	21	"	2 4-ply threads				"	"
NPS–T 9/295	"		27	25	"					"	"
NPS–T 9/296	"		27	27	"	2 4-ply threads		Knotted near warp selvage.		"	"
NPS–T 9/297	Fragment		24	27	"			Tear parallels weft. Edges rolled tightly and overcast with single-ply thread.		"	"
NPS–T 9/298	"		20	22	"					"	"
NPS–T 9/300	"		24	24	"					"	"
NPS–T 9/301	"		32	22	"					"	"
NPS–T 9/305	"		24	24	"					"	"
NPS–T 9/308	"		22	20	"					"	"
NPS–T 9/316	"		24	22	"					"	"
NPS–T 9/317	"		24	27	"					"	"
NPS–T 9/332	"		27	30	"					"	"
NPS–T 9/348	"		24	17	"					"	"
NPS–T 9/349	"				"		2 4-ply threads			"	"
NPS–T 9/350	"				"					"	"
NPS–T 9/351	"				"			Narrow strip, knotted on self with square knot.		"	"
NPS–T 9/352	"		20	17	"					"	"
NPS–T 9/354	"		39	24	"					"	"
NPS–T 9/367	"		30	37	"	2 4-ply threads		Occasionally a weft crosses 2 warps at a time.		"	"
NPS–T 9/377	Fragment		34	34	Red dye?			Very fine weave.		"	"
NPS–T 9/378	"		24	24	Natural					"	"
NPS–T 9/379	"				"					"	"
NPS–T 9/380	"				"		2 4-ply threads			"	"
NPS–T 9/381	"				"					"	"
NPS–T 9/382	"		20	20	"					"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
NPS–T 9/383	Fragment		22	24	Natural					Tonto	P IV
NPS–T 9/387	"				"					"	"
NPS–T 9/388	"				"					"	"
NPS–T 9/389	"				Brown dye?	2 4-ply threads				"	"
NPS–T 9/390	"		20	22	Natural					"	"
NPS–T 9/392	Fragment		22	20	"					"	"
NPS–T 9/397	"				"			Narrow strip.		"	"
NPS–T 9/398	"		24	32	"	2 4-ply threads		2 fragments joined with 3-ply sewing thread.		"	"
NPS–T 9/399	Fragment		22	22	"					"	"
NPS–T 9/400	"		30	27	"					"	"
NPS–T 9/401	Fragment		30	30	"					"	"
NPS–T 9/403	"		27	34	"					"	"
NPS–T 9/404	"		20	24	"					"	"
NPS–T 9/405	Fragment				"			Knotted end of narrow strip.		"	"
NPS–T 9/409	"		24	24	"					"	"
NPS–T 9/410	"		34	42	"					"	"
NPS–T 9/412	"		15	22	"					"	"
NPS–T 9/413	"		27	22	"					"	"
NPS–T 9/414	"		30	17	"			Knotted at one end of 9/109.		"	"
NPS–T 9/415	"				"					"	"
NPS–T 9/416	"		27	24	"			Narrow strip.		"	"
NPS–T 9/417	"		24	24	"			Long strip.		"	"
NPS–T 9/418	"		22	20	"					"	"
NPS–T 9/419	"		24	20	"			Long strip.		"	"
NPS–T 9/420	"		34	30	"	2 3-ply threads		Close, even weave.		"	"
NPS–T 9/423	"				"			Cloth knotted on self with square knot.		"	"
NPS–T 9/424	"		34	30	"			Very fine weave.		"	"
NPS–T 9/437	Inc. $11\frac{3}{8}$	Com. $8\frac{1}{4}$	17	15	"		One has 2 5-ply threads and 2nd has 2 4-ply threads.	Mended near edge with 4-ply thread.		"	"
NPS–T 9/439	Fragment				Pink dye	2 4-ply threads				"	"
NPS–T 9/440	"				Natural			Running-stitch darn in soft, thick single-ply thread.		"	"
NPS–T 9/443	"		17	20	"			Worn. Running-stitch darn shirrs material near one end. Stitches parallel wefts, are in 3 paired rows about 1" apart. Thread single-ply.		"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
NPS–T 9/469	Fragment		24	24	Natural					Tonto	P IV
NPS–T 9/470	"		17	17	"					"	"
NPS–T 9/471	"		17	17	"					"	"
NPS–T 9/472	Fragment				Red dye					"	"
NPS–T 9/473	"		17	17						"	"
NPS–T 9/474	"				Pinkish red, dye?			Color shows on one side, may be painted.		"	"
NPS–T 9/475	"				Natural					"	"
NPS–T 9/486	"				"					"	"
NPS–T 9/487	"				"					"	"
NPS–T 9/488	"				"					"	"
NPS–T 9/492	"		24	26	"					"	"
NPS–T 9/493	"				Pinkish red, dye					"	"
NPS–T 9/494	"		20	17	Natural					"	"
NPS–T 9/495	"		22	22	"					"	"
NPS–T 9/496	"		22	23	"					"	"
NPS–T 9/500	"		22	22	"					"	"
NPS–T 9/501	"		30	32	"					"	"
NPS–T 9/502	"		37	22	"					"	"
NPS–T 9/503	"				"					"	"
NPS–T 9/504	"		27	23	"					"	"
NPS–T 9/524	"		22	24	Red dye?		2 4-ply threads	Red marks on one surface, may be painted.		"	"
NPS–T 9/525	Fragment				"			Red marks on one surface, may be painted.		"	"
NPS–T 9/527	"		42	34	Red dye	2 4-ply threads	2 3-ply threads	One corner complete. Tinges of red on one surface of a gray cotton cloth.		"	"
NPS–T 9/528	Fragment				Pinkish red, dye?			Color on one surface, may be painted.		"	"
NPS–T 9/534	"		27	22	Natural					"	"
NPS–T 9/541	"		24	32	"					"	"
NPS–T 9/543			22	24	"					"	"
NPS–T 9/545	Fragment		17	20	"		2 3-ply threads	Irregular no. of wefts hook through each twist of selvage threads.	f. 93, D	"	"
NPS–T 9/557	"		27	22	"			Tear parallel with warps. Edge rolled and overcast.		"	"
NPS–T 9/562	"		27	22	"	2 3-ply threads				"	"
NPS–T 9/569	Fragment		34	32	Black dye					"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
NPS–T 9/582	Fragment		27	22	Natural					Tonto	P IV
NPS–T 9/583	"		24	27	"					"	"
NPS–T 9/584	"		27	20	"					"	"
NPS–T 9/594	"		32	30	"			Unusually close weave.		"	"
NPS–T 9/601	"		20	20	"					"	"
NPS–T 9/602	"		16	17	"					"	"
NPS–T 9/603	"				"					"	"
NPS–T 9/604	"				"					"	"
NPS–T 9/605	"				"			Weft edge rolled and overcast closely.		"	"
NPS–T 9/609	"		20	15	"					"	"
NPS–T 9/610	"				"			Darned neatly with running-stitch passing regularly over and under 2 warps at a time. Single-ply thread.		"	"
NPS–T 9/611	"				"					"	"
NPS–T 9/612	"				"					"	"
NPS–T 9/613	"				"					"	"
NPS–T 9/614	"		32	30	"					"	"
NPS–T 9/615	"				"					"	"
NPS–T 9/616	"				"			Running-stitch darn, paralleling wefts. Single-ply thread.		"	"
NPS–T 9/617	"		32	30	"					"	"
NPS–T 9/619	"		24	31	"					"	"
NPS–T 9/620	"				"			Weft edge torn, rolled and overcast with single-ply thread.		"	"
NPS–T 9/623	"		24	27	"					"	"
NPS–T 9/624	"		20	23	"					"	"
NPS–T 9/625	"				Brown dye					"	"
NPS–T 9/629	"		22	22	Natural					"	"
NPS–T 9/630	"				"		2 4-ply threads			"	"
NPS–T 9/635	"		22	20	"					"	"
NPS–T 9/644	"		27	30	"		2 4-ply threads	Selvage threads loosely twisted.		"	"
NPS–T 9/646	Fragment				"			Narrow strip knotted to other fragments.		"	"
NPS–T 9/650	"				"	2 4-ply threads		2 warp selvages overcast together with 3-ply thread. Square braids at corners. Braids 1½" long.		"	"
NPS–T 9/651	"		24	31	"					"	"
NPS–T 9/652	"		27	25	"					"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
NPS–T 9/653	Fragment				Natural		2 3-ply threads			Tonto	P IV
NPS–T 9/668	"				Brown dye?		2 3-ply threads			"	"
NPS–T 9/673	"		30	27	Natural					"	"
NPS–T 9/674	"		22	27	"					"	"
NPS–T 9/694	"		22	22	"					"	"
NPS–T 9/705	"		22	20	"					"	"
NPS–T 9/713	Fragments		22	20	"		2 4-ply threads	Several fragments of one cloth.		"	"
NPS–T 9/715b	2 Fragments		22 20	24 17	"					"	"
PM no number	6 Fragments		16 20 30 32	14 18 28 24	Natural					Doolittle Cave, Cliff Ruin #7, Sapillo Creek, Cave #5, Sipe Canyon, Mule Creek Cave.	P III ? P III P III ?
PM–33–62–10/1993	Fragment		26	20	"					Floating House	BM–P II
PM–33–62–10/1995	"		26	44	"					"	"
PM–33–62–10/1997	"		24	20	"					"	"
PM–33–62–10/2000	"		24	25	"			Slit sewed with twine-stitch.		"	"
PM–33–62–10/2002	"		24	20	"			Twine-stitch darning.		"	"
PM–33–62–10/2003	"		24	24	"			Patched with red cloth having 30 warps, 22 wefts per inch.		"	"
PM–33–62–10/2004	"		20	18	"			Edge rolled and overcast.		"	"
PM–33–62–10/2007	"		24	19	"					"	"
PM–33–62–10/2008	"		30	22	"					"	"
PM–33–62–10/2010	"		24	22	"					"	"
PM–33–62–10/2017	"		24	24	"					"	"
PM A1251	"		26	24	"					Sayodneechee Cliff House #2	P III
PM A1321	"		28	26	"					Monument Valley, Ruin #4	"
PM A1374	"		28	26	"					Hagoe, Cliff House #5	P III ?
PM A1425	"		26	18	"		2 2-ply threads			Hagoe, Cliff House #6	"
PM A1559	"				"					Olla House	P III ?
PM A1617	"		20	22	"		2 3-ply threads			Marsh Pass, Cliff House #8	"
PM A1618	"		24	20	"			Twine-stitch darning.		"	"
PM A1710, 1712	2 Fragments		22	20	"					Waterfall Ruin [Chinlee Valley, Cliff House #9]	BM III P III

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
PM A2287	Fragment		34	30	Natural					Kinboko Canyon	? P III
PM A2574	3 Fragments		24 26 30	24 26 24	"					Sunflower Cave	P III
PM A3288	Fragment		28	26	"		2 4-ply threads			Kayenta Area [Yellowhead Canyon]	? P III
PM A3319	17 Fragments		26 22 20 26 36 25	24 22 19 38 26 20	"		1 weft selvage of 2 3-ply threads. Overcast.	Some patching and twine-stitch darning.	p. 578 f. 94, G	Ford House Ruin	P III
PM A3519	6 Fragments		24 22 26 24 26 20	30 26 22 24 28 20	" " " " Brown dye Natural			Edge overcast. Stitching in 2-ply black thread. Patched, weft edge rolled & overcast.		Tsegi-ot-sosi, Cave 8	BM and P III
PM A5018	4 Fragments		30 20 26 22	24 20 22 22	"					Tsegi Canyon, Cave 1, Middle Branch, Grave 1, Burial 2	P I
PM A5019	Fragment		28	26	"					"	"
PM A5056	"		44	26	Black dye					"	P I
PM A6277	"				Natural			Twine-stitch darning.		Floating House	BM–P II
PM A6619	2 Fragments		26 24	20 20	" "	2 3-ply threads				Cedar House	? P III
UM 29.43.349	Fragment		34	22	"			Very finely spun warps. Wrapped around sinew strips.		Southeastern Utah	"
UM 29.43.350	"		34	34	"					"	"
UM 29.43.352	"				"			Fine warps. Very thick, closely battened wefts.		"	"
UM 29.43.353	"		27	34	"			Two pieces sewed together by overcast stitch. Yucca thread.		"	"
UM 29.43.354	"				"			Fine warps. Thick, closely battened wefts.		"	"
UM 29.43.355	"		24	24	"			One row twine-stitching. Embroidery?		"	"
UM 29.43.356	"				Yellow dye					"	"
UM 29.43.357	"				Natural			Few rows twine-stitching. Embroidery?		"	"
UM 29.43.358	"				"			One seam. Overcast stitch.		"	"
UM 29.43.359	"		52	47	"	2 3-ply threads		Very fine, even weave.		"	"
UM 29.43.360	"				"					"	"
UM 29.43.361	"				"			Raw edge rolled and overcast.		"	"
UM 29.43.510	"		22	22		2 3-ply threads				"	"

CHART 2, a *Continued*

Cat. No. or Reference	Dimensions: warp stretch	Dimensions: weft stretch	Thread count: warp	Thread count: weft	Color	Selvages: warp	Selvages: weft	Remarks and description	Fig. and Page	Provenience	Period
USNM 2150	Fragment		22	22	Brown dye					?	?
USNM 156271	"		27	32	Natural					Palatki	P IV
USNM 156273	2 Fragments		"	"	"	2 4-ply threads		Twine-stitch darning or embroidery.		"	"
USNM 156274	Complete weft stretch 9¼		27	20	Stained black	2 2-ply threads	2 2-ply threads			? Palatki	"
USNM 246460	3 Fragments		24 20 37	24 20 27	Natural " "					Tularosa Canyon	?
USNM 312259	20 Fragments				Natural, red, black			Some raw edges rolled and whipped; twine-stitch darning; patching.		Navaho National Monument	? P III
Haury, 1945 *a*: 163, 172, 178–179.	Fragments		35 60 28 24	35 32 24 20	Natural					Los Muertos Las Acequias Los Guanacos	1100–1400 " 700–1100
Haury, 1945 *b*: 27–28.	"		24 to 45	24 to 45	Natural or Brown dye					Painted Cave	P III
Martin *et al.*, 1952: 299.	"				Natural, black or red					Tularosa Cave	P I–III

CHART 2, b

PLAIN WEAVE, TWO-PLY WARPS

NPS–T 9/130	Fragment				Natural			Warps Z-spun, S-twist.		Tonto	P IV
NPS–T 9/411	6½	¾	20	23	"		2 3-ply threads	"		"	"
NPS–T 9/422	Fragment		23	23	"	2 3-ply threads		"		"	"
NPS–T 9/626	4¾	3	13	15	"			"		"	"
NPS–T 9/666	5¾	5½	15	18	"	2 4-ply threads		Some warps Z-spun Z-twist. Some wefts single-ply, others two-ply.		"	"
NPS–T 9/715a	Fragment		13	18	"	2 4-ply threads		Some warps single-ply, others two-ply.		"	"
Wendorf, 1953: 101–102.	"		26	26	"			Warps S-spun, Z-twist. Wefts single-ply, Z-spun.		Te'ewi	P III–IV

CHART 3

PLAIN WEAVE, VARIATIONS

a. PLAIDS AND CHECKS

Cat. No. or Ref.	Dimensions		Description	Fig. and Page	Provenience	Period
	W.s.	w.s.				
ASM VC B#22	40 Inc.	27⅝ Com.	*M*, Wh R W & w. *TC*, 12 prs. W, 17 w. *S*, W & w 3-ply. Check. Paired warps—usually a pair contains 1 R & 1 Wh W. *Chart 15*.	pp. 493, 496, 605 f. 11, B; 13	Ventana Cave	1000–1400
ASM 4031	Inc.	Inc.	*M*, Wh R W & w. *TC*, 25 W, 19 w. *S*, W 3-ply thrs. Plaid.	p. 493 f. 11, C; 14	Verde Valley Salt Mine	P III–IV ?
NPS-T Lower Ruin	3½ Inc.	2⅞ Inc.	*M*, Wh D Blu 1-ply W, Wh D Blu 1-ply or 2-ply w. *TC*, 24 W, 26 w. *S*, w 3-ply thrs. Plaid.	p. 493	Tonto, Lower Ruin	P IV
NPS-T 9/38	3⅜ Inc.	6¾ Inc.	*M*, Wh Br 1-ply & 2-ply W & w. *TC*, 24 W, 20 w. Plaid.	p. 493 f. 11, A	Tonto	P IV
PM-A 5058	7½ Inc.	6 Inc.	*M*, Wh Br W & w. *TC*, 27 W, 21 w. Check.	p. 493 f. 11, D	Tsegi Canyon, Cave 1, Grave 1, B. 2	P I
Haury, 1934, p. 91	Inc.	Inc.	*M*, Wh L Br W & w. *TC*, 15 W, 20 w. *S*, W 2 4-ply thrs., each contains 2 Wh & 2 Br strands. Plaid or check?	p. 493	Canyon Creek	P IV

b. PLAIN WEAVE, HALF-BASKET

ASM VC B#22			Paired warps. See *check* above.		Ventana Cave	1000–1400
ASM 3018			Paired warps. *Chart 7, a*.		Gourd Cave	P III
NPS-T 9/376	Inc.	Inc.	*M*, Br W, Bl w. *TC*, 25 W, 15 prs. w. Paired wefts. May be part of plaid cloth.	p. 496 f. 10, C	Tonto	P IV

c. PLAIN WEAVE, HEAVY DECORATIVE WEFTS

AMNH 29.1/7897a	Inc.	5½ Com.	*M*, Wh W, Wh 1-ply & 5-ply w. *TC*, 29 W, 20 w. *S*, w 2 2-ply thrs. 4 5-ply wefts worked in to form 2 decorative bands.	p. 497 f. 10, J	White House, Room 3	P III
ASM 5408	Inc.	Inc.	*M*, Wh W, Wh 1-ply & 3-ply w. *TC*, 22 W, 20 w. 3-ply wefts worked in every other pick.	p. 497 f. 10, I	Unknown	?
NPS-T 9/28	Inc.	Inc.	*M*, Wh 2-ply W, Wh 2-ply & paired 2-ply w. *TC*, 10 prs. W, irreg. w. *S*, W finished edge. Eccentric plain weave.	p. 497 f. 10, H; 15, A	Tonto	P IV
PM 33-62-10/2005	8½ Com.	10½ Com.	*M*, Wh W, Wh 1-ply & paired 3-ply thrs. w. *TC*, 23 W, 18 w. *S*, W 3-ply thrs. overcast, w. 3-ply thrs. 3 bands decorative heavy wefts. Some twine-stitch darning with 1-ply thr.	pp. 497, 617 f. 10, G	Floating House	BM–P II

d. PLAIN WEAVE, RAG-WEFT

AMNH 29.1/5508	Inc.	Inc.	*M*, bast W, rag strips & double bast w.	p. 499 f. 10, D	Verde Valley	P III–IV ?
ASM 9329	Inc.	Inc.	*M*, 1-ply Br cotton W, Br rag strips & 1-ply w. *TC*, 12 W, 8 rag strip w.	p. 500	Unknown	?
ASM 14559	Inc.	Inc.	*M*, 5-ply cotton W, rag w. *TC*, 10 W, 6 rag strip w. Rag wefts hook thru selvage cords as in regular plain weave.	p. 499 f. 10, F; 16	Tonto	P IV

CHART 3 (*Continued*)

d. PLAIN WEAVE, RAG-WEFT (*Continued*)

Cat. No. or Ref.	Dimensions		Description	Fig. and Page	Provenience	Period
	W.s.	w.s.				
NPS-MC 4	2⅝ Inc.	5½ Inc.	*M*, cotton W, rag strips or bundles cotton thr. & 1-ply cotton thr. w. *TC*, 14 W, 4 rag strips & 11 thrs. w. *S*, W 5 edge thrs. over which warp loops. Thr. bundles or rag strips spaced 2–3 weft rows apart.	p. 499 f. 10, E	Montezuma Castle	P III–IV
NPS-MC 11	Inc.	Inc.	*M*, yucca baccata W, rag strips & paired yucca baccata w. *TC*, 9 W, irreg. w. Rag wefts spaced 1–5 fiber weft rows apart. Each fiber weft is paired. Rag strips may have been red.	p. 499 f. 10, D; 17	Montezuma Castle	P III–IV
NPS-MC 17	Inc.	Inc.	*M*, yucca elata W, rag strips & paired yucca elata w. *TC*, 8 W, irreg. w. 5 paired fiber wefts between rag strips. Rag strips may have been red.	p. 499 f. 10, D	"	"
NPS-MC 53	Inc.	Inc.	*M*, yucca baccata 1-ply W, rag strips & yucca baccata 2-ply w. *TC*, 8 W, irreg. w. Irregular spacing of rag wefts.	p. 499 f. 10, E	"	"
NPS-MC 54	3½ Inc.	17 Inc.	*M*, 2-ply cotton W, 1-ply cotton & bundles of 6–9 cotton thr. w. *TC*, 13 W, 4 bundles & 11 thrs. w. Bundles at intervals of 3–5 regular wefts. Thrs. in bundles may be warps of cloth with wefts worn out.	p. 499 f. 10, E	"	"
NPS-T 9/33	Inc.	Inc.	*M*, 1-ply cotton W, rag strip w. *TC*, irreg. W, 8–10 rag strip w. *S*, W 3-ply thrs. 5-strand flat braid, at corner of cloth.	pp. 499, 593 f. 10, F	Tonto	P IV
NPS-T 9/116	Inc.	Inc.	*M*, 1-ply cotton W, rag strip w.	p. 499 f. 10, F	"	"
NPS-T 9/221	Inc.	Inc.	*M*, 2-ply cotton W, rag strip w.	"	"	"
NPS-T 9/299	Inc.	Inc.	*M*, 2-ply cotton W, rag strip w. *S*, w 4-ply thrs.	"	"	"
NPS-T 9/302	Inc.	Inc.	*M*, 1-ply cotton W, rag strip w.	"	"	"
NPS-T 9/304	Inc.	Inc.	*M*, 2-ply bast W, rag strip w.	"	"	"
NPS-T 9/305	Inc.	Inc.	*M*, 2-ply cotton W, rag strip w.	p. 499 f. 10, F	Tonto	P IV
NPS-T 9/425	Inc.	Inc.	*M*, 2-ply cotton W, rag strip or paired cotton thrs. w.	p. 499 f. 10, D	"	"
NPS-T 9/546	Inc.	Inc.	*M*, 2-ply cotton W, rag strip & thr. w.	p. 499 f. 10, E	"	"
NPS-T 9/627	Inc.	Inc.	*M*, 1-ply cotton W, rag strip w.	p. 499 f. 10, F	"	"
NPS-T 9/714	Inc.	Inc.	*M*, 2-ply cotton W, rag strip & 1-ply bast thr. w. *S*, w 4-ply thrs.	p. 499 f. 10, E	"	"
NPS-T R-3			Rag-weft pad. See *Chart 22*.		"	"
USNM no no.	Inc.	Inc.	*M*, bast W, rag strip & paired bast w.	p. 499 f. 10, D	Camp Verde?	P III–IV ?
USNM 156272	Inc.	Inc.	*M*, cotton W, bundles of slightly twisted cotton strip w. *TC*, 14 W, 8 bundles w. Bluish-gray in color.	p. 499 f. 10, F	Palatki	P IV
USNM 156275			Probably part of above cloth. (See also Hough, 1914, pp. 81–82, Fig. 170.)	"	"	"

CHART 3 (*Continued*)

d. PLAIN WEAVE, RAG-WEFT (*Continued*)

Cat. No. or Ref.	Dimensions		Description	Fig. and Page	Provenience	Period
	W.s.	w.s.				
USNM 254860			No information on piece.	p. 499	Mesa Verde?	P III ?
Fewkes, 1912, p. 147			"Agave fiber most abundant, used in combination with cotton."	p. 497	Casa Grande	1200–1400 ?
Fewkes, 1896, p. 272			"Cotton and agave" cloth.	p. 497	Honanki	P III–IV ?
Haury, 1934, p. 102	Inc.	Inc.	*M*, apocynum W, rag strip w.	p. 499 f. 10, F	Canyon Creek	P IV
Haury, 1934, p. 102	Inc.	Inc.	*M*, apocynum W, rag strip & paired apocynum w. 2 paired bast wefts alternate with 1 rag strip.	p. 499 f. 10, D	"	"
Haury, 1934, p. 102	Inc.	Inc.	*M*, apocynum W, rag strip & apocynum w. Strips Bl, spaced 2–4 weft rows apart.	p. 499 f. 10, E	"	"

CHART 4

WEFT-WRAP OPENWORK AND GAUZE

Cat. No. or Ref.	Dimensions		Description	Fig. and Page	Provenience	Period
	W.s.	w.s.				
AMNH 29.1/7540	$3\frac{3}{16}$ Inc.	$5\frac{11}{16}$ Inc.	White. *TC*, 38 W, 28 w. *S*, W 2 4-ply thrs. Wrapping both parallel and oblique to warp-weft lines. Every 4th weft a wrapper. $1\frac{3}{8}$" plain weave border at warp edge.	p. 503	White House	P III
AMNH 29.1/7990A	11 Com.?	Inc.	White. *TC*, 25 W, 26 w. Wrapping usually parallels warp-weft lines. Every 4th weft a wrapper. $1\frac{1}{2}$" plain weave borders at warp edges. For design see ASM 2151.	p. 503	White House, Room 4	"
AMNH 29.1/7990B	Inc.	Inc.	White. *TC*, 25 W, 26 w. Wrapping usually parallels warp-weft lines. Every 4th weft a wrapper.	p. 503 f. 18, E	"	"
ASM no no.	Inc.	Inc.	White. *TC*, 44 W, 28 w. *S*, w 2 3-ply thrs. Wrapping parallels warp-weft lines. Every 4th weft a wrapper.	p. 503	Verde Valley Salt Mine	P III–IV ?
ASM 2151	$15\frac{3}{8}$ Com.	$12\frac{1}{2}$ Com.?	White. *TC*, 25 W, 20 w. *S*, W 2 4-ply thrs. w 2 3-ply thrs. Wrapping parallel and oblique to warp-weft lines. Every 4th or 2nd weft a wrapper. Plain weave borders: $\frac{3}{4}$" wide on weft edge; $2\frac{1}{4}$" & $2\frac{3}{4}$" wide at warp edges.	pp. 503, 505, 617, 628, 631 f. 22, A; 114, F; 137, F	Cave Town Ruin	P III ?
ASM 19936?	Inc.	Inc.	White. *TC*, 26 W, 24 w. Wrapping parallels warp-weft lines. Every 4th weft a wrapper.	p. 503	Kayenta area?	P III ?
ASM 20299	Inc.	Inc.	Charred. *TC*, 32 W, 30 w. Row holes $\frac{3}{16}$" apart.	p. 502	4 mi. no. of Casa Grande, in grave	P IV ?
ASM 23295	Inc.	Inc.	White. *TC*, 36 W, 40 w. Wrapping parallels warp-weft lines. Every 4th weft a wrapper. Very fine. Also gauze weave.	pp. 503, 506	Kayenta area?	P III ?
ASM 24026 (2 fragments)	$4\frac{3}{4}$ Inc.	$14\frac{1}{4}$ Inc.	White. *TC*, 38 W, 30 w. Finished edges. Wrapping parallels warp-weft lines. 2 fragments sewed at weft edges.	pp. 503, 631 f. 27	"	"

CHART 4 (*Continued*)

Cat. No. or Ref.	Dimensions		Description	Fig. and Page	Provenience	Period
	W.s.	w.s.				
ASM 25955	Inc.	Inc.	White. *TC*, 26 W, 20 w. Wrapping parallels warp-weft lines. Every 4th weft a wrapper	p. 503	Kayenta area?	P III ?
ASM 26236	15½ Com.	Inc.	White. *TC*, 26 W, 20 w. *S*, W 2 3-ply thrs. Wrapping parallels warp-weft lines. Every 4th weft a wrapper.	pp. 503, 508, 617 f. 24, A	Cottonwood	P III–IV ?
ASM VC B#9	Inc.	Inc.	Stained brown. *TC*, 37 W, 24 w. Every 4th or 2nd weft a wrapper. Probably border of plain weave cloth.	p. 504 f. 21; 139, M	Ventana Cave	1000–1400
ASM VC B#22	Inc.	Inc.	Stained brown. *TC*, 26 W, 26 w. Wrapping oblique or parallel to warp-weft lines. Every 2nd weft a wrapper. Chevron patterns on plain weave.	p. 503	"	"
ASM VC B#22	28 Com.	8⅝ Com.	Brown. *TC*, 28 W, 18 w. *S*, W 2 3-ply thrs. Wrapping usually parallels warp-weft lines. Every 4th weft a wrapper. Also gauze weave. Child's poncho. *Chart 16*.	pp. 503, 506, 607 f. 24, C; 25; 26; 113 C; 139, B	"	"
ASM VC B#34	17½ Inc.	17⅝ Inc.	Stained brown. *TC*, 30 W, 32 w. *S*, W 2 3-ply thrs. Wrapping parallel and oblique to warp-weft lines. Every 4th weft a wrapper.	p. 503 f. 23; 139, I	"	"
MNA 621/405 M. 25	2⅜ Inc.	1⅝ Inc.	White. *TC*, 19 W, 19 w. Wrapping parallels warps or wefts. Every 4th weft a wrapper.	p. 503	Wupatki	P III
MNA 695/NA 2519 153a, b	Inc.	Inc.	White. *TC*, 30 W, 24–25 w. 3 fragments. Wrapping parallels warp-weft on 2 fragments, oblique on third. Every 4th weft a wrapper.	"	Kiet Siel	"
NPS-MC 34	Inc.	Inc.	White. *TC*, 26 W, 26 w. Wrapping parallels warp-weft lines. Every 4th weft a wrapper.	p. 503 f. 18, C; 22, B; 139, J	Montezuma Castle	P III–IV
NPS-MC 35	Inc.	Inc.	White. *TC*, 27 W, 27 w. Wrapping parallel & oblique to warp-weft lines. Every 4th weft a wrapper.	p. 503	"	"
NPS-MC 36	Inc.	Inc.	White. *TC*, 34 W, 34 w. Wrapping parallels warp-weft lines. Every 4th weft a wrapper. Gauze weave.	pp. 503, 506 f. 28, A	"	"
NPS-MC 37	Inc.	Inc.	White. *TC*, 35 W, 35 w. Wrapping parallels warp-weft lines. Every 4th weft a wrapper. Gauze weave.	"	"	"
NPS-T R16-12	Inc.	Inc.	Stained brown. *TC*, 34 W, 29 w. Wrapping parallels warp-weft lines. Every 4th weft a wrapper.	p. 503	Tonto	P IV
NPS-T 9/176	Inc.	Inc.	Charred? brown. Wrapping parallels warp-weft lines. Every 4th weft a wrapper.	"	"	"
NPS-T 9/249	Inc.	Inc.	White. *TC*, 29 W, 24 w. Wrapping parallels warp-weft lines. Every 4th weft a wrapper.	"	"	"
NPS-T 9/421	11¾ Inc.	5⅜ Inc.	White. *TC*, 24 W, 22 w. Wrapping parallels warp-weft lines. Every 4th weft a wrapper.	p. 503 f. 18, D	"	"
NPS-T 9/517	Inc.	Inc.	Dyed brown. Wrapping parallels warp-weft lines. Every 4th weft a wrapper.	p. 504	"	"
NPS-T 9/523	Inc.	Inc.	White. *TC*, 34 W, 24 w. Wrapping parallels warp-weft lines. Every 4th weft a wrapper.	p. 503	"	"

CHART 4 (*Continued*)

Cat. No. or Ref.	Dimensions		Description	Fig. and Page	Provenience	Period
	W.s.	w.s.				
NPS-T 9/544	Inc.	Inc.	Dyed? brown. *TC*, 40 W, 29 w. Wrapping parallel or oblique to warp-weft lines. Every 4th weft a wrapper.	p. 504	Tonto	P IV
NPS-T 9/591	$6\frac{1}{8}$ Inc.	$4\frac{3}{8}$ Inc.	Stained brown. *TC*, 24 W, 24 w. Every 2nd weft a wrapper. Weft-wrap border of a gauze weave fabric.	pp. 503, 506 f. 19, B; 28, B	"	"
NPS-T 9/593	Inc.	Inc.	Stained brown. Wrapping parallels warp-weft lines. Every 4th weft a wrapper.	p. 503	"	"
NPS-T 9/645	Inc.	Inc.	White. *TC*, 24 W, 23 w. Every 2nd weft a wrapper.	p. 503 f. 19, A, C	"	"
PM 95483 (Cosgrove, 1947; 78, fig. 31, *a*)	Inc.	Inc.	White. *TC*, 24 W, 20 w. Every 4th weft a wrapper. Warps twined at edge of openwork pattern.	p. 503 f. 18, F	Doolittle Cave	P III ?
PM 34-12-10/2738 (*Ibid.*, fig. 86, *a*, *b* and *d*)	9 Inc.	8 Inc.	White. *TC*, 28 W, 28 w. Finished—no extra selvage thrs. Wrapping parallel & oblique to warp-weft line. Every 2nd weft a wrapper. Weft edges overcast together to form tubular article.	pp. 503, 505 f. 20; 139, L	Mule Creek Cave	"
USNM 232153	Inc.	Inc.	White. *S*, w 2 3-ply thrs. Warps & wefts of S-spun cotton. Gauze weave. (Hough, 1914: 80, fig. 166.)	p. 508 f. 28, D	Bear Creek Cave	P III
USNM 232153a	Inc.	Inc.	White. Wefts beaten close as in plain tapestry weave. Gauze weave. (May be same as Hough, 1914: 79, fig. 165 & 232152a.)	p. 508	"	"
USNM 246123a, b, c	Inc.	Inc.	White. *TC*, 50 W, 29 w. *S*, w 2 3-ply thrs. $\frac{3}{16}''$ holes made in fabric. Also wrapping with every 4th weft. (Hough, 1914: 77–78, fig. 160, 161.)	p. 501 f. 18, B; 139, E	"	"
USNM 363987-8	$6\frac{3}{4}$ Com.	$6\frac{3}{4}$ Com.	White. *TC*, 24 W, 20 w. *S*, W 2 2-ply thrs., w 2 2-ply thrs. Every 4th weft a wrapper. Central design in shape of diamond, $3\frac{1}{2}''$ on a side.	pp. 503, 617 f. 24, E; 114, E; 139, A	?Graham County, Arizona	
Gladwin *et al.*, 1937: 161–162, fig. 62	Inc.	Inc.	Charred. *TC*, 38 W, 38 w. Parallel holes in cloth.	p. 502 f. 18, A	Snaketown	900–1100
Haury, 1934: 93, fig. 19, pl. LX, *a*	Inc.	Inc.	White. *TC*, 32 w. Wrapping parallel & oblique to warp-weft lines. Every 4th weft a wrapper. Bag. *Chart 21.*	pp. 503, 505, 621 f. 22, C; 139, C	Canyon Creek	P IV
Haury, 1943: 97	Inc.	Inc.	White. Gauze.	p. 506	Verde Valley Salt Mine	P III–IV ?
Haury, 1934: 97 & pl. LX, *b*	6 Com.?	c. 48 Com.	White. Gauze weave with weft-wrap on 1 end border. Sash?	pp. 503, 506, 508, 619	Tonto	P IV
Hough, 1914: 78, fig. 162	Inc.	Inc.	White. Every 4th weft a wrapper.	p. 503	Bear Creek Cave	P III
Hough, 1914: 78–79, fig. 163 (USNM 252105)	Inc.	Inc.	Charred. Thought to be weft-wrap border of a plain weave piece.	pp. 503, 509 f. 24, D; 139, D	Casa Grande	P IV
Hough, 1914: 80	6 Com.	$5\frac{1}{4}$ Com.	White. Gauze.	pp. 506, 508, 617	Solomonsville, cave near	?
Pvt. Collection Sante Fe	Inc.	Inc.	White. *TC*, 24 W, 24 w. Wrapping parallel & oblique to warp-weft line. Every 4th weft a wrapper. Several fragments.	pp. 503, 631 f. 22, D, E	Canyon de Chelly?	P III?

CHART 5

a. EMBROIDERY

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
AMNH H/12587(152)	Fragment		30	27	Brown cloth, natural embroidery threads			Twine-stitch; stitches 2 warps wide. Embroidery thread, 4-ply.	p. 514	Grand Gulch	? P III
AMNH H/14360	Inc. 48	Inc. 24			Natural cloth, natural threads			Twine-stitch. 2-ply thread.	"	Poncho House or Lower Chinlee Valley	"
AMNH H/15736	Fragment				"			"	"	Grand Gulch or Kayenta	"
AMNH 29.1/2897D	"		22	30	"	2 3-ply threads		Twine-stitch and running-stitch. 2-ply thread.	pp. 512, 514	White House	P III
AMNH 29.1/7542a & b	2 Fragments		30	27	Red cloth, natural thread			Twine-stitch. Embroidery forms meander pattern on *b*. 2-ply threads.	p. 514 f. 32, E, F	"	"
AMNH 29.1/7543	Fragment				Brownish cloth, natural and black threads			Twine-stitch. Coarse embroidery threads, 2-ply.	p. 514	"	"
AMNH 29.1/7757	"		34	30	Natural cloth, natural thread			Twine-stitch.	"	"	"
AMNH 29.1/7897b & c	2 Fragments				"			Twine-stitch, 2-ply thread. Each stitch one warp long.	"	"	"
AMNH 29.1/8428	"				Red cloth, natural thread	2 3-ply threads		Running-stitch, 2-ply threads.	p. 512	"	"
ASM—no number (& also fragment marked #6601)	"		22 20	18 22	Natural cloth, natural and blue threads			Running-stitch. 2-ply threads. Blue and white bands 1" wide alternate on cloth. "False diamond twill" design; stitches going O-3 U-3 warps.	p. 513 f. 33	Nitsie Canyon	? P III
ASM 2150	Fragment		22	21	Natural cloth, natural thread			Running-stitch. 2-ply threads. O-3 U-3 "false diamond twill."	p. 512	Gourd Cave	P III
ASM 2990	"		24	24	"			Running-stitch and twine-stitch. 2-ply threads. Band embroidery $\frac{11}{16}$" wide, $3\frac{1}{4}$" long.	p. 512 f. 32, D	"	"
ASM 2991	"		24	24	"			Running-stitch. 2-ply threads. O-3 U-3 "false diamond twill."	p. 512 f. 32, G; 34, A	"	"
ASM 3013	"				"			Running-stitch embroidery (?). O-2 U-2 "false diagonal twill." Twine-stitch flanks embroidered band. 2-ply threads.	p. 512 f. 34, B; 90, D	"	"
MNA 695/NA2519.M229c	"		20	22	Natural cloth, natural or yellow thread			Twine-stitch. 2-ply threads. Stitches 2 warps or 2 wefts wide. Some running-stitch in colored thread.	p. 514	Kiet Siel	"

CHART 5 *Continued*

Cat. No. or Reference	Dimensions		Thread count		Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft		warp	weft				
MNA 695/NA2519.M250	2 Fragments		20	20	Natural cloth, red thread	a. 2 2-ply threads. Row twine-stitching inside this. b. 2 4-ply threads. Row twine-stitching 2 weft picks in.		Running-stitch. 2-ply threads. 2 fragments sewed together with overcast stitch.	p. 512	Kiet Siel	P III
MNA 696/NA746.1	Fragment		20	22	Natural cloth, grey-blue and brown threads	2 3-ply threads		Double running-stitch.	pp. 551, 635 f. 35, D; 36; 138, E	Walnut Canyon	"
NPS–T 9/441 & 9/442	2 Fragments		27	17	Natural cloth, dark blue-green threads		2 3-ply threads	"	pp. 515, 631 f. 35, B; 37, B	Tonto	P IV
NPS–T 9/712 & 9/713	3 Fragments		32	24	Natural cloth, natural thread	2 4-ply threads	2 4-ply threads	Wrap-stitch. Single-ply soft-spun thread.	pp. 515, 629 f. 35, A, C; 37, A; 138, J	"	"
USNM 312259	6 Fragments				"			Twine-stitch and some running-stitch.	p. 514	Navaho National Monument	P III ?
Pvt. Collection, Phoenix, Arizona					Natural cloth, brown and blue threads			Complete cigaret "sash." Probably double running-stitch embroidery. *Chart 23.*	pp. 515, 621 f. 30, A	Olberg, cave near.	P IV ?
Amsden, 1949: 117, footnote 8								Embroidery fragments in P. G. Gates Collection, Southwest Museum, Los Angeles. No further information.	p. 518	Upper Gila drainage	?
b. BROCADE											
AMNH 14/228	6 Com.	5½ Com.			Natural cloth brown brocade threads			Bag. *Chart 21.*	pp. 512, 621 f. 31; 139, F	Verde Valley	P III–IV ?
AMNH 29.1/5508 (Morris, 1928: 94–95)	7¼ Inc.	7¼ Com.	34	26	"		2 3- & 4-ply threads	May be sash end or bag fragment.	p. 512 f. 29; 39, G	Clear Creek group of cavate lodges near Camp Verde	"
GP 17130 (Haury, 1934: 98 & Pl. LXI)					"			Probably a fragment of a cradle band. *Chart 20.*	pp. 512, 621 f. 30, B	Canyon Creek	P IV

CHART 6

PLAIN WEAVE TAPESTRY

Cat. No. or Reference	Dimensions		Thread count		Material		Color		Description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft	warp	weft	warp	weft				
AMNH–14/224	Inc.	Com. *ca.* 1″	12	27	Tightly twisted single-ply cotton	Single-ply cotton	Grayish brown (stain)	White, light tan, dark tan, orange-red	Wefts pass over 2, 4 or 6 warps 3 times, then move one warp to right or left and repeat. Slit tapestry tie.	pp. 522, 619 f. 44; 138, A	Montezuma Castle	P III–IV
AMNH–29.0/9975	Com. 20	Com. 3¼			Yucca	Cotton	Natural	?	Tump line. Plain tapestry.	p. 525 f. 123, O	Aztec	P III
AMNH–29.1/7993					Fiber	Cotton	Natural	Yellow gray	Slit tapestry band.	p. 524	White House	"
ASM 2775	Com. 13⅜	Com. 4¾	*ca.* 3 pairs	*ca.* 12	Paired 2-ply cotton threads	2-ply cotton threads	Natural	White, brown, yellow, faded	Slit and interlocking tapestry. Cradle band. Warps strung between two sticks. *Chart 20.*	—	Nitsie Canyon, small ruin near Inscription House	? BM III–P I
ASM 3446	Inc. 5¼	Com. 3⅛	8	52	2-ply cotton	2-ply cotton	"	Probably 3 colors—now faded	Slit tapestry. Row twine-stitching just inside one edge. May be reinforcement as edge is slightly worn. *Chart 20.*	—	Gourd Cave	P III
MNA 77/NA405.M234	Inc. 10⅜	Com. 3	12	38	2-ply yucca	Cotton, 1-ply	Natural, yellowish yucca	White, blue, yellow	Tump-line with one end loop remaining. 17 yucca cords were looped about a support at their centers, thus forming 34 warps over which the cotton wefts are woven. Both slit & interlocking tapestry appear.	p. 525 f. 42, A; 138, G	Wupatki	"
MNA 695/NA2519.466	Inc. 2⅜	Com. ? 1⅜	8	37	2-ply yucca?	2-ply cotton	Natural yellowish	White, brown	Slit and interlocking tapestry fragment. Pattern is of irregular brown zigzags.	p. 524	Kiet siel	"
MNA 695/NA2519.714	Inc. 10¾	Com. 2¼	8	30	"	"	"	White	Tump-line. Plain tapestry. One end, showing looping of warp threads. This piece was covered with a dark substance—perhaps pitch.	p. 525	"	"
MNA 1032/NA1629.117	Inc. 3 7/16	Inc. 1⅜	13	32	Probably yucca	Cotton	?	?	Charred fragment. Slit tapestry.	p. 524	Kinnikinnick	P III–IV
NPS–MC 12	Inc. 7	Com. 3¾	11	29	Yucca baccata	"	Natural	Natural Yellow black	Slit tapestry band. Weft woven over 3–5 warps at a time.	p. 524 f. 50	Montezuma Castle	"

CHART 6 *Continued*

Cat. No. or Reference	Dimensions		Thread count		Material		Color		Description	Fig. and Page	Provenience	Period
	warp stretch	weft stretch	warp	weft	warp	weft	warp	weft				
NPS–T no number (Steen, 1935: 458–459)	Inc.	Com. *ca.* 1½			Yucca	Cotton	Natural	White, brown, red	Slit tapestry. End loop of carrying band.	p. 524 f. 138, B	Tonto	P IV
NPS–T 9/41	Inc. 14⅜	Com. ¾	8 in piece	30	1-ply cotton	1-ply cotton, thick	"	Natural or blue-black	Slit tapestry. Narrow tie.	pp. 522, 619 f. 45	"	"
PM 3196	Inc. 6	Com. 5¼	7	52	2-ply Z-twined yucca	1-ply cotton, soft, thick	"	Brown or Natural	Slit tapestry band. Probably a cradle band. *Chart 20.*	—	Unknown, probably no. Arizona	?
PM A5058	Inc. *ca.* 16	Com. 2¼	20 in piece	50	Half are 2-ply cotton used in units of 3. Half are 2-ply brown hair or wool used in units of 3.	2-ply cotton	Cotton—black, Hair—brown	Natural Yellowish-brown	Slit tapestry band. Pattern in zigzag lines 4 warps wide.	p. 525	Tsegi Canyon, Cave 1, Middle Branch, Grave 1, Burial 2	P I
UM 29.27.37	Inc. 9¼	Com. 3¼			?	Cotton	?	Black, red, yellow, white	Slit tapestry band.	p. 524	Forbidden (Forbidding?) Canyon	P III ?
USNM 156276 (Hough, 1914: 80–81)	Com. 16⅛	Com. 4½	12	60	2-ply cotton	1-ply cotton	Natural	Natural. Possibly once dyed.	Slit tapestry cradle band. *Chart 20.*	—	Palatki	P IV
Cummings, 1915: 6					Yucca	Cotton			Band said to be yucca warp, dyed cotton fill. Looks like tapestry weave.	p. 526 f. 47, A, 2	Unknown, probably no. Arizona	?
Pepper, 1920: 108	Inc. 8¼	Inc. ? *ca.* 1			"	"		Brown, white	"Burden band of cotton and yucca." "Eye-hole" in one end.	p. 525	Pueblo Bonito	P II–IIIa
See also:												
ASM 20491									Quiver. *Chart 22.*	—	Hidden House	P III
ASM 20493									Kilt. Plain weave with tapestry insets. *Chart 22.*	—	"	"
ASM 23492									Crescent-shaped object. *Chart 22.*	—	Unknown, probably no. Arizona	?
ASM 25982									Skirt band, slit tapestry. *Chart 18.*	—	"	"
MNA 695/NA2519.759									Skirt band, slit and interlocking tapestry. *Chart 18.*	—	Kiet Siel	P III

CHART 7

PLAIN WEAVE WARP-FACE BANDS AND WARP-FLOAT PATTERN WEAVES

a. PLAIN WEAVE WARP-FACE BANDS

Cat. No. or Ref.	Dimensions		Description	Fig. and Page	Provenience	Period
	W.s.	w.s.				
AMNH 14/216	Inc.	$\frac{7}{8}$ Com.	*M*, 1-ply Wh W & w. 2 finished edges, no selvage threads. *TC*, 62 W, 43 w. Very fine weave, slightly warp-face.	p. 529	Verde Valley	P III–IV ?
ASM 3018	8 Inc.	$1\frac{3}{4}$ Com.	*M*, 2-ply soft, thick, Br Wh W, 2-ply Wh w. Finished edges, no selvage threads. *TC*, 15 prs. W in band, 5 w per inch. *Chart 3, b.*	p. 530 f. 52, B; 53, C	Gourd Cave	P III
ASM 13389	24 Inc.	$1\frac{1}{2}$ Com.	*M*, 1-ply Br Wh W, 1-ply Br? w. *TC*, 82 W in band. Tie found with mummy of child.	p. 530 f. 53, A	Cottonwood	P III–IV ?
ASM 20485	2 fragments $64\frac{1}{2}$ $77\frac{3}{4}$ Inc.	1 Com.	*M*, 1-ply Wh W & w. *S*, w 2-ply thrs. *TC*, 34 W, 17 w. Belting used as wrapping on agave stalk medicine box.	p. 529	Hidden House	P III
ASM 20491	$18\frac{1}{2}$ Inc.	$\frac{3}{4}$ Com.	*M*, 1-ply Wh W & w. Sling of quiver. *Chart 22.*		"	"
ASM 20498	Inc.	$\frac{9}{16}$ Com.	*M*, 1-ply Wh Bl W, 1-ply W w. *S*, w 2-ply threads. *TC*, 40 W in band, 11 w per inch. Breech cloth belting.	p. 530 f. 53, B; 114, L, 2	"	"
ASM 20499	"	"	As above. Probably part of same belt.	p. 530 f. 53, B	"	"
ASM-A 4752	"	"	*M*, 1-ply Wh W & w. Narrow tie of rabbit fur blanket on mummy of child.	p. 529 f. 52, A	Ventana Cave	1000–1400
ASM no number			*M*, 1-ply Wh W & w. Breech cloth belting.	"	"	"
MNA 561/739.2	Inc.	$\frac{5}{8}$ Com.	*M*, 1-ply Wh W & w. *S*, w 2-ply threads. Breech cloth belting.		Walnut Canyon	P III
MNA 693/405S4.91	$4\frac{3}{4}$ Inc.	$\frac{7}{8}$ Com.	*M*, 1-ply Bl W & w. Finished edges, no selvage threads. Narrow tie. *TC*, 24 W per $\frac{1}{2}$", 21 w per 1".		Wupatki	P III
NPS-MC 7	Inc.	$\frac{5}{8}$ Com.	*M*, 1-ply Wh W & w. *S*, w 2-ply threads. *TC*, 17 W per $\frac{1}{2}$ inch, 17 w per inch.		Montezuma Castle	P III–IV
NPS-T R-1	Inc.	$1\frac{3}{4}$ Com.	*M*, 1-ply Wh W & w. *S*, w 2-ply threads. *TC*, 52 W, 10 w.	p. 529 f. 51, B	Tonto	P IV
NPS-T 9/113	"	Inc.	*M*, 1-ply Wh W & w. One finished edge, no selvage threads. *TC*, 57 W, 10 w.	p. 529	"	"
NPS-T 9/703	"	"	*M*, 1-ply Wh W & w. One finished edge. *TC*, 44 W, 11–12 w.	p. 529	"	"
NPS-T 9/704	"	"	*M*, 1-ply Wh W & w. One finished edge. *TC*, 37 W, 11–12 w.	p. 529	"	"

b. WARP-FLOAT PATTERN WEAVES

NPS-T 9/207	Inc.	Inc.	4 fragments. *M*, 2-ply Wh Br W, 1-ply soft Br w. *S*, W plain weave border, w 2-ply thrs. *TC*, 15 W, 12 w.	p. 531 f. 51, C, D; 53, F	Tonto	P IV
NPS-T 9/542	Inc.	$\frac{7}{8}$ Com.	*M*, 1-ply Wh W, 2-ply Wh w. 2 finished edges, no selvage thrs. *TC*, 56 W in band, 12 w per inch.	p. 531 f. 51, A; 53, E	"	"

CHART 8

Floated Weaves

a. Twills

Cat. No. or Ref.	Dimensions		Description	Fig. and Page	Provenience	Period
	W.s.	w.s.				
AMNH H/3151 Pepper, 1920: 107, fig. 39	Inc.	Inc.	*M*, Wh W, Wh Bl R w. *TC*, 30 W, 31 w. 2/2 rev. twill, Ana. stripe. Fine warps & wefts.	p. 540 f. 54, B	Pueblo Bonito	P II–IIIa
AMNH H/7690	Inc.	Inc.	*M*, Wh W, Wh Bl R w. *TC*, 21 W, 32 w. 2/2 diag. twill, Ana. stripe.	"	"	"
AMNH H/9465	Inc.	Inc.	*M*, Wh W, Wh Bl R w. *TC*, 21 W, 32 w. 2/2 diag. twill, Ana. stripe.	"	"	"
AMNH H/13468	Inc.	Inc.	*M*, Wh W, Wh Bl R w. *TC*, 30 W, 32 w. 2/2 rev. twill, Ana. stripe.	"	Grand Gulch or Kayenta	P III ?
AMNH H/13836	Inc.	Inc.	*M*, Wh W, Wh Bl R w. *TC*, 30 W, 32 w. 2/2 rev. twill, Ana. stripe.	"	"	"
AMNH H/14565	Inc.	Inc.	*M*, Wh W, Wh R w. *TC*, 16 W, 50 w. 2/2 diag. twill tapestry. "Beaded" section of Ana. stripe cloth	"	"	"
AMNH 29.1/1457	Inc.	Inc.	*M*, Wh W, Wh Bl w. *TC*, 20 W, 22 w. 2/1 twill tapestry.	p. 553 f. 54, A	Mummy Cave	P III
AMNH 29.1/7547	Inc.	Inc.	*M*, Wh W, Wh Bl Br R w. 2/1 diag. twill, Ana. stripe. 3 fragments.	p. 538 f. 54, A	White House	P III
AMNH 29.1/7679A	Inc.	Inc.	*M*, Wh W, Wh Br R w. 1/2 diag. twill, plus 3-thread diam. twill tapestry.	pp. 540, 547, 562, 564 f. 65, D	White House Room 6	"
AMNH 29.1/7679B, C, D	Inc.	Inc.	*M*, Wh W, Wh Br R w. 2/1 rev. twill, Ana. stripe.	p. 538 f. 54, A	White House	"
AMNH 29.1/7895A, D	Inc.	Inc.	*M*, Wh W, Wh Br R w. 2/1 twill tapestry. Zigzag line design.	p. 553 f. 54, A	"	"
AMNH 29.1/7895B	7½ Inc.	12¼ Com.	*M*, Wh W, Wh or Br? w. *TC*, 24 W, 20 w. *S*, w 2 2-ply thrs. Single-ply W, 2-ply coarse w. 2/2 irreg. twill.	pp. 551, 562 f. 68, B	"	"
AMNH 29.1/7895C	Inc.	Inc.	*M*, Wh W, Wh Br Bl R w. 2/1 twill, Ana. stripe plus twill tapestry.	pp. 553, 562, 564 f. 54, A; 67, A	"	"
AMNH 29.1/7896	Inc.	Inc.	*M*, Wh W, Wh Br R w. 2/1 twill tapestry. Zigzag line design. Part of AMNH 29.1/7895A, D?	p. 553 f. 54, A	"	"
AMNH 29.1/7991	Inc.	Inc.	*M*, Wh W, Wh Br R w. *TC*, 14 W, 24–60 w. *S*, w 2 2-ply thrs. 2/1 diag. twill, Ana. stripe.	p. 538 f. 54, A	"	"
ASM 16142	Inc.	Inc.	*M*, Wh W, Wh Br R w. *TC*, 20 W, 42 w in beaded sections. *S*, W 2-ply thrs. 2/1 diag. twill, Ana. stripe.	p. 538 f. 54, A	Zele Cave	P III ?
BM 12653	12⅝ Inc.	20 Inc.	*M*, Wh W, Wh Br R w. *TC*, 16 W, 20–30 w. 2/1 rev. twill, Ana. stripe. Patched & darned. One patch has dia. twill pattern in black	pp. 538, 540, 543, 562 f. 54, A; 56; 81, E	Canyon de Chelly	"

CHART 8 (*Continued*)

a. TWILLS (*Continued*)

Cat. No. or Ref.	Dimensions		Description	Fig. and Page	Provenience	Period
	W.s.	w.s.				
CSHS 01454	Inc.	Inc.	*M*, Wh W, Wh Br R w. *TC*, 20 W, 26 w. 2/1 diag. twill, Ana. stripe.	p. 538 f. 54, A	Mesa Verde	P III
CSHS 01460	Inc.	Inc.	*M*, Wh W, Wh Bl R w. *TC*, 35 W, 35 w. *S*, W 2 2-ply thrs. 2/2 rev. twill, Ana. stripe.	p. 540 f. 54, B	"	"
CSHS 01461	8¼ Inc.	6½–4½ Com.	*M*, Wh W, Wh Br R w. *TC*, 27 W, 46 w. *S*, W 2 2-ply thrs. w 2 3-ply thrs. 2/1 diag. twill, Ana. stripe. Probably a breech cloth front. *Chart 17*.	pp. 538, 540, 562, 613 f. 54, A	"	"
CU no no.	4 Inc.	8¼ Com.	*M*, Wh W, Wh, Bl R w. *TC*, 10 W, 24 w. *S*, W 2 2-ply thrs. possibly fringed, w 2 3-ply thrs. 2/1 diag. twill, Ana. stripe.	pp. 538, 540, 562, 613 f. 54, A	Aztec	"
LA L.30/109	Inc.	Inc.	*M*, Wh W, Wh, Br R w. 2/2 rev. twill, Ana. stripe.	p. 540 f. 54, B	Black Creek LA #1521	P III ?
LA L.30/139	Inc.	Inc.	*M*, Wh W, Wh Br R w. *TC*, 24 W, 27–70 w. 2/2 diag. twill, Ana. stripe.	"	Hospitibito Canyon	"
MNA 77/NA405. M233	6⅛ Inc.	7⅝ Com. ?	*M*, Wh W, Wh Blu Br w. *TC*, 18 W, 16 w in pw & 27 w in twill. *S*, finished edges, no selvage thrs. 2/2 twill tapestry. Border of plain weave cloth	pp. 555, 562 f. 70; 71; 138, D	Wupatki	P III
MNA 77/NA405. M235	9¾ Inc.	5½–6½ Com.	*M*, Br W, Bl Br w. *TC*, 16–18 W, 13–14 w. *S*, W 2 2-ply thrs. with fringe of 6 thrs. looped through cloth, w 2 2-ply thrs. 2-ply coarse cotton throughout. 3/3 rev. twill. 1½" plain weave warp border.	pp. 540, 562, 578, 613 f. 54, D; 58, B; 94, H	"	"
MNA 484/2399a	2⅜ Inc.	1⅞ Inc.	*M*, Wh W & w. *TC*, 20 W, 16 w. 2/2 rev. twill.	p. 540 f. 54, B	"	"
MNA 627/405. M224 (b)	10 Inc.	2 1/16 Inc.	*M*, 2-ply Wh W & w. *TC*, 17 W, 20 w. Diagonal bands 2/2 twill alternated with bands of plain weave.	p. 551 f. 58, A; 68, A	"	"
MNA 695/NA2519. M259	4¾ Inc.	¾ Inc.	*M*, 2-ply Wh W & w. 3/1 diag. twill.	p. 540 f. 54, C	Kiet Siel	"
MNA 695/NA2519. M337	9 Com.	3 Inc.	*M*, Wh W, Wh Br w. *TC*, 21 W, 21 w. *S*, W 3-ply thrs. 2/2 rev. twill with brocaded weft float center pattern.	pp. 561, 562, 617	"	"
MNA 695/NA2519. M347	2¾ Inc.	1¼ Inc.	*M*, Wh W, Wh Br w. 2/2 rev. or dia. twill, brocaded.	p. 556 f. 67, E	"	"
MNA 695/NA2519. 784	1 Inc.	1 Inc.	*M*, Wh W, Wh R w. 2/2 diag. twill. Probably "beaded" section of Ana. twill.	p. 540 f. 54, B	"	"
MNA 712/NA2630 R3.7b	4 Inc.	1½ Inc.	*M*, Wh W, Bl R Wh w. *TC*, 30 W, 25 w. Twill or weft-float.	p. 559 f. 32, C	Lenaki	"
MNA 850/NA35.1	2⅝ Inc.	2⅜ Inc.	*M*, Wh W, Wh Bl w. *TC*, 16 W, 15 w. *S*, W 3-ply thrs. 2/2 rev. twill.	p. 590 f. 54, B	Wupatki, vicinity of	?
MNA 1233/A1481	5 Inc.	5½ Inc.	*M*, Wh W, Wh Br w. *TC*, 21 W, 30–45 w. *S*, W 2 3-ply thrs. w 2 3-ply thrs. 3-thr. dia. twill tapestry. Negative line design.	pp. 547, 562 f. 65, A, B, C; 66; 137, J	Unknown, probably Northern Arizona	?

CHART 8 (*Continued*)

a. TWILLS (*Continued*)

Cat. No. or Ref.	Dimensions		Description	Fig. and Page	Provenience	Period
	W.s.	w.s.				
NMSM Acdc 25/1	Inc.	Inc.	*M*, Wh W, Wh Bl R w. *TC*, 24 W, 49 w. 2/1 diag. twill, Ana. stripe. Fragment from mummy of child.	p. 538 f. 54, A	Canyon de Chelly	P III ?
NMSM 783–791	Inc.	Inc.	*M*, Wh W, Wh Bl R w. *TC*, 40 W, 30 w. Very even weave. 2/2 twill, Ana. stripe.	p. 540 f. 54, B	Chetro Ketl	P II–IIIa
NPS-AM 5338	Inc.	Inc.	*M*, Wh W, Wh Bl R w. *TC*, 25 W, 32 w. *S*, W 2 4-ply thrs. 2/2 dia. twill. Ana. stripe.	p. 543 f. 58, C; 59, A; 81, E	Aztec	P III
NPS-MC 56	Inc.	Inc.	*M*, Wh W, Wh Bl R w. 3/3 dia. twill tapestry.	p. 545 f. 59, B; 61	Montezuma Castle	P III–IV
NPS-T X-38	3¼ Inc.	9 Inc.	*M*, Wh W & w. *TC*, 40 W, 32 w. 2/2 diag. twill, exceptionally fine, regular weave.	p. 540 f. 54, B	Tonto	P IV
PM A1620	Inc.	Inc.	*M*, Wh W, Wh R w. 2/2 diag. twill, Ana. stripe.	p. 540 f. 54, B	Marsh Pass, Cliff House #8	P III
PM A1709	Inc.	Inc.	*M*, Wh W, Wh Br R w. 2/1 diag. twill, Ana. stripe.	p. 538 f. 54, A	Waterfall Ruin	"
PM 33-62-10/1996	Inc.	Inc.	*M*, Wh W, Br w. *TC*, 28 W, 24 w. 2/2 dia. twill, very fine work.	p. 543	Floating House, Kiva 1	BM–P II
PM 33-62-10/2012	Inc.	Inc.	*M*, Wh W, Wh Br R w. 2/1 diag. twill, Ana. stripe.	p. 538 f. 54, A	Floating House, Turkey Kiva	"
UM 29.43.112	11½ Inc.	10½ Com.	*M*, Wh W, Wh Br R w. *TC*, 20 W, 35 w. *S*, W 3 2-ply thrs., w 2 2-ply thrs. 2/1 twill tapestry, lightning design. May be sash or breech cloth.	pp. 539, 563 f. 55; 54, A	Southwestern Colorado	?
UM 29.43.122	Inc.	Inc.	*M*, Wh W, Wh Br R w. 2/2 dia. twill, Ana. stripe.	p. 543 f. 59, A; 60; 81, E	"	"
USNM Y	Inc.	Inc.	*M*, Wh W & w. 2/2 diag. twill.	p. 540 f. 54, B	Navaho National Monument	"
USNM 257.363	Inc.	Inc.	*M*, Wh W, Wh Br R w. 2/1 diag. twill, Ana. stripe.	p. 538 f. 54, A	Mesa Verde?	P III ?
Baldwin, 1939: 321			2/2 twill.	p. 540 f. 54, B	Kinishba	P III
Cushing, 1893			"Twilled or diagonal weaving."	p. 565	Salt River Valley	?
Haury, 1945*a*: 179, fig. 116	Inc.	Inc.	*M*, Wh Br W & w, 2-ply W, 3-ply w. *TC*, 16 W, 16 w. Broken twill, 2/2.	p. 549 f. 67, B	Los Guanacos	900–1100
Haury, 1945*b*: 34	Inc.	Inc.	*M*, Wh W, Wh Bl R w. *TC*, 20 W, 28–40 w. 2/1 diag. twill, Ana. stripe.	p. 538 f. 54, A	Painted Cave	P III

CHART 8 (*Continued*)

a. TWILLS (*Continued*)

Cat. No. or Ref.	Dimensions W.s.	Dimensions w.s.	Description	Fig. and Page	Provenience	Period
Martin *et al.*, 1952: 299–300	Inc.	Inc.	*M*, Wh W, Wh Bl Blu w. 4-thr. dia. twill tapestry. Unit design on plain weave cloth.	pp. 544, 562, 629 f. 62, A; 63; 138, C	Tularosa Cave	P III
Nordenskiöld, 1893: pl. L	Inc.	Inc.	*M*, Wh W, Wh Br w. Twill tapestry? Border of plain weave cloth.	pp. 554, 562 f. 69; 137, I	Mesa Verde	"
See also:						
AMNH H/14400			Bag. 2/1 twill with weft-float center design. *Chart 21.*	—	Grand Gulch	P III ?
AMNH H/15982			Blanket. Dia. twill tapestry. *Chart 15.*	—	"	"
AMNH 29.1/7710			Breech cloth. 2/1 rev. twill. *Chart 17.*	—	White House	P III
ASM 2983			Breech cloth. Double-weft twill. *Chart 17.*	—	Gourd Cave	"
ASM 20492			Quiver. 3/3 twill tapestry. *Chart 22.*	—	Hidden House	"
MNA NPS/NA405R 7B27			Cigaret "sash." *Chart 23.*	—	Wupatki	"
NPS–AM 954 & 4000			Blanket. 2/2 diag. twill, Ana. stripe. *Chart 15.*	—	Aztec	"
NPS–T 9/483			Breech cloth. 2/2 twill tapestry. *Chart 17.*	—	Tonto	P IV
UM 29.43.153			Bag. 2/2 rev. twill, Ana. stripe. *Chart 21.*	—	Southwestern Colorado	?
Haury, 1945*a*: 202 & pl. 90, *h*			Cigaret "sash." *Chart 23.*	—	Double Butte Cave	P IV ?

b. WEFT-FLOAT PATTERN WEAVES

AMNH 21.9/7897D	Inc.	Inc.	*M*, Wh W & w. *S*, W 2 3-ply thrs. 3 floated 2-ply wefts.	p. 558 f. 32, A	White House	P III
BM 03.250–6			Breech cloth. Brocaded weft-float center. *Chart 17.*	—	"	"
NPS–MC 18	25 Com.	5¾ Com.	*M*, Wh W, Bl w. *TC*, 40 W, 28 w. Wefts always paired. Bag. *Chart 21.*	—	Montezuma Castle	P III–IV
NPS–MC 33	7½ Inc.	4 Inc.	*M*, Wh W, Bl w. *TC*, 25 W, 32 w. Wefts not paired.	p. 559	"	"

CHART 9

APPLIED DECORATIVE TECHNIQUES

a. TIE-DYE

Cat. No. or Ref.	Dimensions W.s.	Dimensions w.s.	Description	Fig. and Page	Provenience	Period
AMNH 29.1/7541a	6¼ Inc.	2¾ Inc.	*TC*, 37 W, 22 w. Yellow or faded brown dye. White squares with dark center dots placed close together in double rows which run oblique to warp-weft lines.	p. 568 f. 137, A	White House	P III
ASM 2984	Inc.	Inc.	*TC*, 26 W, 20 w. Blue-gray dye. Design as above.	p. 568 f. 82	Gourd Cave	"
ASM 23560	Inc.	Inc.	Brown dye.	p. 568	Northern Arizona	?
MNA 77/NA405. M232	7½ Inc.	7¼ Inc.	*TC*, 28 W, 22 w. Black dye. Design as above.	"	Wupatki	P III
MNA 695/NA2519. M295	Inc.	Inc.	*TC*, 20 W, 20 w. Blue-gray dye. Design as above.	"	Kiet Siel	"
PM A1709 ?	Inc.	Inc.	Brown dye.	"	Waterfall Ruin	"
UM 29.43.183	44 Com.	51½ Com.	Brown dye. 25 white diamonds 1¾" across, each with a ¼" square brown dot in the center, arranged in 5 parallel rows. Blanket. *Chart 15.*	—	Lake Canyon	P III ?
Haury, 1934: 99–100, pl. LXI, *b*	Inc.	Inc.	Brown dye. White circles *ca.* ⅜" in diameter with brown centers. Circles are arranged in 2 rows *ca.* ¾" apart.	p. 568	Canyon Creek	P IV
Haury, 1934: 100			Blue-gray dye. Squared spots.	"	Kayenta region	P III ?

b. PAINTING

AMNH no no.	6 9/16 Inc.	6 5/16 Inc.	*TC*, 34 W, 34 w. Brown paint on yellowish cloth. Negative painting, simulated tie-dye design of light squares with dark center dots.	p. 570 f. 137, B	Kayenta region ?	P III ?
	5⅜ Inc.	5⅜ Inc.	*TC*, 37 W, 25 w. Color & design as above.	"	"	"
ASM 484	42 Inc.	4¾ Inc.	*TC*, 24 W, 22 w. Red, yellow & brown paint. Weft edge of painted poncho or blanket. Design in bands running oblique to warp-weft line. *S*, w 3-thr. *Chart 15.*	—	Little Kiet Siel, Nitsie Canyon	P III ?
ASM 20511			Blanket. *Chart 15.*	—	Hidden House	P III
BM 03.251	24⅝ Inc.	18⅜ Inc.	*TC*, 22 W, 18 w. Red paint. Negative painting. "Mosquito-bar" designs in bands oblique & parallel to warp-weft line. *S*, w 6-ply thrs.	p. 571 f. 85; 137, G	White House	"
PM A5614			Shirt. *Chart 16.*	—	Poncho House	"
Haury, 1934: 99			Red paint. ¾" band applied to the sewed edge of a bag. *Chart 21.*	—	Canyon Creek	P IV
Haury, 1945*b*: 28–34			2 blankets. *Chart 15.* 1 poncho. *Chart 16.*	—	Painted Cave	P III
Ibid., 74–75			Fragment painted dark brown.	p. 570	Mesa Verde	"

CHART 9 (*Continued*)

b. PAINTING (*Continued*)

Cat. No. or Ref.	Dimensions W.s.	Dimensions w.s.	Description	Fig. and Page	Provenience	Period
Ibid., 75			Blanket fragment. *Chart 15.*	—	Montezuma Castle	P III–IV
c. COUCHING						
USNM 250178			Breech cloth. *Chart 17.*	—	Unknown	?

CHART 10

NON-LOOM FABRICS HAVING WARPS AND WEFTS

a. WEFT-TWINE

Cat. No. or Ref.	Dimensions W.s.	Dimensions w.s.	Materials W.	Materials w.	Description	Fig. and Page	Provenience	Period
AMNH 29.1/1227	—	—	yucca	cotton?	—	p. 583	Canyon del Muerto	P III ?
CU, no no.	—	—	yucca	cotton	—	"	Mesa Verde ?	P III ?
PM A–1655 (Kidder and Guernsey, 1919: 117)	19 Com.	2½ Com.	yucca	cotton	Wefts clasp 2 warps at a time to make twill effect. 2 end loops bound with cotton cord in continuous figure-8 weave.	p. 583 f. 6, D; 2	Waterfall Ruin	P III
USNM 254.848	14½ Inc.	½ Com.	yucca	cotton	Decorated by stripes, 3 thrs. wide, of brown yucca fiber wefts twined in. Stripes about ¾" apart.	p. 583	Mesa Verde ?	P III ?
USNM 254.849	19¾ Com.	2¾ Com.	yucca	cotton	Line coated with black substance. Cotton braid knotted through one end loop.	"	"	"
USNM 257.360	18½ Com.	3⅛ Com.	yucca	cotton	5 decorative bands of weft-twine in yucca threads at center of band. Loop at one end, warps knotted together at one end.	"	"	"
Cummings, 1910: 10	—	—	yucca	cotton	—	"	Tsegi-ot-sosi	P III ?
Fewkes, 1909: figs. 22, 23; 1911*a*: fig. 4	—	—	yucca	cotton	—	p. 583	Mesa Verde	P III
Nordenskiöld, 1893: pl. XLIX, 2	—	—	yucca	cotton	—	"	"	"
b. COUNTERPAIRED WARP-TWINE								
NPS–T 9/600	19¾ Inc.	⅜ Com.	1-ply white, dark blue	1-ply white	—	p. 581 f. 96, A	Tonto	P IV
c. WEAVING ON A CYLINDER OF WARPS								
NPS–T 9/60	3½ Inc.	⅞ Com.	Single-ply, black		29 warps, 22 wefts per inch. Pattern is O–3, U–3, reversed twill.	pp. 583, 623 f. 97, C	Tonto	P IV

CHART 10 (*Continued*)

c. WEAVING ON A CYLINDER OF WARPS (*Continued*)

Cat. No. or Ref.	Dimensions		Materials		Description	Fig. and Page	Provenience	Period
	W.s.	w.s.	W.	w.				
NPS-T 9/61	5¼ Inc.	1 Com.	Single-ply, black		As 9/60.	pp. 583, 623 f. 97, C	Tonto	P IV
NPS-T 9/62	3½ Inc.	¾ Com.	1-ply black	2-ply black	20 warps, 24 wefts per inch. Pattern is O-2, U-2, reversed twill.	"	"	"
PM-A 1848, 1849, 1850 (Kidder and Guernsey, 1919: 147–150, pl. 62)	*ca.* 5 Com.	2 Com.	white	dark	Pattern is floated weft resembling fancy twill. *Chart 21*	pp. 583, 623 f. 97, D; 123, E	Sunflower Cave	P III

CHART 11

LOOPING

a. CLOSED LOOP FABRICS

Cat. No. or Ref.	Material	Description	Fig. and Page	Provenience	Period
AMNH 29.1/7934	Two 2-ply cotton strings, brown & yellow wool twisted between them.	Sock fragment. Diam. 5".	pp. 589, 618 f. 40, G	White House	P III
AMNH 29.1/7992	4-ply cotton string, feathers (?) twisted into it.	Looping hangs from fiber braid.	p. 587 f. 40, G	"	"
ASM 1026	4-ply cotton string, wool between plies.	Shoe-sock. Heel to sock top, 11". Twilled yucca? fiber sole, 11½" long, 4" wide at ball of foot.	pp. 589, 618 f. 101; 114, M	Two Mummy Ruin	P III ?
ASM 1983	3-ply cotton.	Medicine bag, contains small stones. 3½"×1¾". *Chart 21.*	pp. 587, 623 f. 100; 123, C	Gourd Cave	P III
ASM 2768	4 6-ply cotton strings with dark & light wool twisted between them.	Shoe-sock. Heel to sock top, 9¾". Twilled yucca? fiber soles, 8"–10" long, 4" wide at ball of foot. Ankle tie of square cotton braid with pompoms.	pp. 589, 618 f. 102	"	"
ASM 3017	2-ply cotton string.	Probably a bag fragment. Diam. ¾". Length, inc., 4".	pp. 587, 623 f. 40, G	"	"
ASM 3447	4-ply cotton string with brown & yellow wool twisted between plies.	Probably a sock fragment.	pp. 589, 618 f. 40, G	"	"
ASM 3448	4-ply cotton string with brown wool between plies.	Sock fragment. Diam. 5½".	pp. 589, 618 f. 99, A	"	"
ASM 20492	2-ply cotton string.	Bottom of a quiver. *Chart 22.*		Hidden House	P III
MNA 695/NA2519. 421	6-ply cotton string.	Fragment.	p. 587 f. 40, G	Kiet Siel	"
MNA 695/NA2519. M352	2-ply cotton string, charred.	Fragment.	p. 587 f. 40, G	"	"

CHART 11 (*Continued*)

a. CLOSED LOOP FABRICS

Cat. No. or Ref.	Material	Description	Fig. and Page	Provenience	Period
USNM 270.244	Heavy cotton string.	Looped bags, containing jade knife, feathers, prayer sticks.	pp. 587, 624 f. 40, G	Navaho Natl. Monument	P III ?
Kelly, mss., n.d.: 13	Human hair cord & strips of cotton cloth knotted together.	Bag.	p. 587	McEuen Cave	?
Kidder & Guernsey, 1919: 106, pl. 40, *a*	Cotton and brown animal hair string.	Shoe-sock. Closed loop yucca? cord sole.	pp. 589, 618 f. 40, G	Kayenta area	P III ?
		b. LOOPING OVER FOUNDATION CORDS			
PM 95535a (Cosgrove, 1947: 76, fig. 85)	Single-ply S-spun cotton, size of #100 commercial thread.	Foundation cords of round 6-strand braids, joined by a separate thread looped between them.	p. 589	Greenwood Cave	P III
PM 95535b (*Ibid.*)	"	Fragment, $\frac{5}{8}$" wide by $1\frac{1}{2}$" long. Six 2-ply, Z-twist warp strings, joined by extra threads looped between them.	p. 589 f. 112, E	"	"
Ibid., 122–123	Cotton and yucca (?).	Small net-like cylinder used as a foundation for feathers. Cotton (?) strings held together by yucca thread looped around them. (Our analysis of technique places this as a plaited, rather than a looped, fabric.)	p. 590 f. 96, D	Mule Creek Cave	P III ?
		c. NETTING			
GP 116	2-ply white cotton.	Sash? $131\frac{1}{2}$" long by $11\frac{3}{4}$" wide (top to bottom). Mesh 1" in diam. Overhand knot. Complete.	pp. 592, 619 f. 98, C; 104; 123, Q	McEuen Cave	?
GP 117	Single-ply white cotton.	Sash? Irregular meshes. Overhand knot. $95\frac{1}{2}$"×9" (top to bottom). Complete.	pp. 592, 619 f. 98, A	"	"
GP 118	2-ply dark gray cotton.	79" long×$98\frac{1}{2}$" wide at bottom. Netting knot.	p. 591 f. 98, B	"	"
GP 119	2-ply brown cotton.	110" long, $25\frac{1}{2}$" at lower edge. Netting knot. In some areas knots are grouped into decorative diamonds. Complete.	p. 591 f. 98, F	"	"
GP 120	2-ply cotton, white and 4 shades of brown.	30" long, 38" wide (at lower edge). Netting knot. Netting "needle" at unfinished lower edge.	p. 591 f. 98, E; 103	"	"
Cosgrove, 1947: fig. 82, *b*, *c*, *g*	Cotton.	3 fragments. Netting knot.	p. 591 f. 98, E	Cave 8, Hueco Mtns. Chavez Cave	P ? P ?
Martin *et al.*, 1952: 302	2-ply Z-twist cotton.	Sash? 20"×4", tied into circular band. Lark's head knot.	pp. 592, 619 f. 98, D	Tularosa Cave	500–700

CHART 12

BRAIDING

Cat. No. or Reference	Dimensions		Material (All cotton)	Color	Description	Fig. and Page	Provenience	Period
	Length	Width						
AMNH—no number	Fragments		2-ply	Natural	Square.	p. 595 f. 105, B	Pueblo Bonito	P II–IIIa
AMNH H/12260	Inc.	Folded lengthwise and sewed. 1″ wide.	"	"	Flat, O–2 U–2. Bag. *Chart 21*	—	Grand Gulch	P III ?
AMNH H/14618	Fragment		"	"	Flat, O–2 U–2. One edge reinforced with buttonhole stitch in 2-ply thread.	p. 593 f. 91, C; 105, D	Poncho House or Lower Chinlee Valley	"
AMNH 29.1/1213	Inc.	1⅛	?	"	Flat, O–2 U–2.	p. 593 f. 105, D	Mummy Cave	P III
AMNH 29.1/1214	"	1	?	"	"	"	"	"
AMNH 29.1/7545	"	5⅛	2-ply	Natural	"	"	White House	"
AMNH 29.1/7664	Fragment		"	"	"	"	"	"
AMNH 29.1/7723	Inc.	1⅛	"	"	"	"	"	"
AMNH 29.1/7898 A, B	Fragments		"	"	"	"	"	"
AMNH 29.1/7898 C	2 Fragments Inc. Inc.	 1⅛ 3⅛	"	"	"	"	"	"
AMNH 29.1/7994	17¼	1⅝	"	"	Tump line or sling. Flat, O–2 U–2, and also braiding around a core. *Chart 22.*	—	"	"
AMNH 29.1/8110	Fragment		"	"	Flat, O–2 U–2.	p. 593 f. 105, D	"	"
ASM—no number	"		2-ply	Natural	Flat, O–2 U–2	"	Ventana Cave	1000–1400
ASM B #9	"		"	"	"	"	"	"
ASM Lower C–2	"		"	"	"	"	"	"
ASM 491	"		"	"	"	"	Tsegi Canyon	P III ?
ASM 513	Inc.	Com. ⅜	"	"	Flat, O–2 U–2. 16 strands. Strands separated to form 2 8-strand braids, one above other, then further divided into 4-strand braids, which end in tassels. Very fine work.	p. 593 f. 105, E	"	"
ASM 2834	Fragment		"	"	Square, 8-strand.	p. 595 f. 105, B	Gourd Cave	P III
ASM 2835	"		"	Speckled brown and white. May be natural brown cotton or may be some dyed fibers.	"	pp. 595, 600 f. 105, B	"	"
ASM 2839	"		"	Natural	Square, 14-strand. Tassel at end.	p. 595 f. 105, C	"	"
ASM 2840	"		"	"	Square. 8-strand. Tassel at end.	p. 595 f. 105, B	"	"
ASM 2896	Inc.	3⅜	"	"	Flat, O–2 U–2. *ca.* 85 strands. One frayed edge reinforced by buttonhole stitch.	pp. 576, 593 f. 91, C; 105, D	"	"
ASM 3002	Inc.	1	"	"	Flat, O–2 U–2.	p. 593 f. 105, D	"	"
ASM 3003	2 Fragments Inc.	 Inc. 1⅜	"	"	"	"	"	"

CHART 12 *Continued*

Cat. No. or Reference	Dimensions		Material (All cotton)	Color	Description	Fig. and Page	Provenience	Period
	Length	Width						
ASM 3005	Inc.	1	2-ply	Natural	Flat, O–2, U–2.	p. 593 f. 105, D	Gourd Cave	P III
ASM 3007	Inc.	1	"	"	Flat, O–2 U–2. 28 strands.	"	"	"
ASM 3008	Inc.	1 1/16	"	"	Flat, O–2 U–2.	"	"	"
ASM 3009	Fragment		"	"	Flat, O–2 U–2. Ends straight across bottom, with small 8-strand square braids. There are 11 of these existent, so piece must have had at least 88 strands originally.	p. 593 f. 105, D	"	"
ASM 3023	"		"	"	Flat, O–2 U–2.	p. 593 f. 105, D	"	"
ASM 3024	Inc.	1 1/4	"	"	Flat, O–2 U–2. Start end complete.	p. 593 f. 105, D; 106	"	"
ASM 3025a–i	10 Fragments		"	"	Flat, O–2 U–2.	p. 593 f. 105, D	Gourd Cave and other caves in Nitsie Canyon	P III ?
ASM 3435	8 1/4	3/16	"	"	Square, 8-strand. Tassel on one end.	p. 595 f. 105, B	Gourd Cave	P III
ASM 3589	Inc.	1/8	"	"	Square, 8-strand.	p. 595 f. 105, B	"	"
ASM 20501	1 1/2	1/4–1/2	"	"	Square, 8-strand. Braid forming tassel at corner of plain weave fragment.	p. 525 f. 105, B	"	"
ASM 25517	Fragment		"	"	Flat, O–2 U–2.	p. 593 f. 105, D	Gourd Cave	P III
ASM 25956	Inc.	3 3/8	"	"	"	"	Unknown, Northern Arizona	P III ?
ASM 25959	Inc.	3 1/8	"	"	"	"	"	"
ASM 25965	Inc.	11/16	"	"	"	"	"	"
ASM 25987	Inc.	7/8	"	"	"	"	"	"
ASM 25999	Fragment		"	"	"	"	"	"
ASM 26002	"		"	"	"	"	"	"
ASM 26006	Inc.	1 1/8	"	"	"	"	"	"
LA 30/137	Fragment		"	"	Flat, O–2 U–2, ending in 8-strand square braids extending from V-point.	p. 593 f. 105, D	Hospitibito Canyon	P III ?
MNA 695/NA2519.40	"		"	"	Square, 8-strand.	p. 595 f. 105, B	Kiet Siel	P III
MNA 695/NA2519.M71	Inc.	1	"	"	Flat, O–2 U–2.	p. 593 f. 105, D	"	"
MNA 695/NA2519.152	Inc.	1 5/8	"	"	" "	"	"	"
MNA 695/NA2519.181	Several Fragments		"	"	Square, 8-strand.	p. 595 f. 105, B	"	"
MNA 695/NA2519.M229b	Inc.	1 3/8	"	"	Flat, O–2 U–2.	p. 593 f. 105, D	"	"
MNA 695/NA2519.M251b	Inc.	7/8	"	"	"	"	"	"
MNA 695/NA2519.M252b	Inc.	7/8	"	"	"	"	"	"

CHART 12 *Continued*

Cat. No. or Reference	Dimensions		Material (All cotton)	Color	Description	Fig. and Page	Provenience	Period
	Length	Width						
MNA 695/NA2519.M253b	Fragment		2-ply	Natural	Square, 8-strand.	p. 595 f. 105, D	Kiet Siel	P III
MNA 695/NA2519.531	Inc.	$\frac{1}{2}$	"	"	"	"	"	"
MNA 695/NA2519.532	Fragment		"	"	Flat, 3-strand. Each strand is composed of two untwisted threads.	pp. 593, 600	"	"
MNA 695/NA2519.668	Inc.	$1\frac{3}{4}$	"	"	Flat, O–2 U–2.	p. 593 f. 105, D	"	"
MNA 695/NA 2519.712	Inc.	$2\frac{1}{8}$	"	"	"	"	"	"
MNA 695/NA2519.738	Inc.	$1\frac{1}{8}$	"	"	Flat, O–2 U–2 braid, with 2 8-strand square braids at one end. Probably had 4 square braids originally, thus containing 32 strands in all.	p. 593 f. 105, D	"	"
MNA 695/NA2519.777	Inc.	$1\frac{1}{8}$	"	"	Flat, O–2 U–2. Overcast along one edge.	"	"	"
MNA 909/NA2519	Fragment		"	"	Square, 8-strand. Tassel at one end	p. 595 f. 105, B	"	"
NMSM 783–791	"		"	"	Flat, O–2 U–2.	p. 593 f. 105, D	Chetro Ketl	P II–IIIa
	Inc.	$\frac{5}{16}$	3-ply, Z-spun, S-twist	"	Square	p. 595 f. 105, B	"	"
NPS–MC 20	Inc.	$1\frac{1}{16}$	2-ply	"	Flat, O–3 U–3. 49 strands.	p. 593 f. 105, A	Montezuma Castle	P III–IV
NPS–T—no number	Inc.	$\frac{1}{16}$	Single-ply	"	Flat, O–3 U–3. Exceptionally finely spun thread.	"	Tonto	P IV
NPS–T R16–15	Inc.	$\frac{1}{4}$–$\frac{3}{8}$ diameter	2-ply	Natural and 2 shades of brown	Braiding around a core.	p. 597 f. 96, E; 114, L, 3	"	"
NPS–T 9/33	$2\frac{1}{2}$		"	Natural	Flat, O–2 U–2. Tassel at corner of rag-weft cloth. *Chart 3, d.*	—	"	"
NPS–T 9/81	Inc.	$\frac{1}{16}$	Single-ply	"	Flat, O–3 U–3. 28 strands.	p. 593 f. 105, A	"	"
NPS–T 9/86	Fragment		"	"	"	"	"	"
NPS–T 9/98	Inc.	$1\frac{1}{2}$	2-ply	"	Flat, O–3 U–3.	"	"	"
NPS–T 9/99	Fragment		"	"	"	"	"	"
NPS–T 9/215	"		Single-ply	Charred brown and and black	"	p. 594	"	"
NPS–T 9/649	"		"	Natural	"	p. 593 f. 105, A	"	"
NPS–T 9/650			4-ply	"	Square, 8-strand. Tassel at corner of plain weave cloth.	p. 595 f. 105, B	"	"
NPS–T 9/655	Fragment		Single-ply	"	Flat, O–3 U–3.	p. 593 f. 105, A	"	"
PM A1557 (Kidder & Guernsey, 1919: 114)	Inc. $6\frac{3}{4}$		2-ply	Natural	Flat, O–2 U–2. Changing to square braid with cotton string "ball" on end.	p. 595 f. 105, F	Olla House (Cliff House #7, Laguna Creek)	P III ?
PM A1558	Fragment		"	"	Square. Cotton "ball" on end.	p. 595	"	"

CHART 12 *Continued*

Cat. No. or Reference	Dimensions		Material (All cotton)	Color	Description	Fig. and Page	Provenience	Period
	Length	Width						
PM A1559 (Kidder & Guernsey, 1919: 114)	Fragment		2-ply	Natural	Flat, O–2 U–2. Finished off at one end in 4 6-strand round braids.	p. 593 f. 105, D	Olla House (Cliff House #7, Laguna Creek)	P III ?
PM 96939	1		3-ply	"	Square, 6-strand. Tassel at corner of plain weave cloth.	p. 595 f. 105, B	Cliff Ruin #7, Sapillo Creek	P III
PM 97394	Inc.	½	Single-ply	Red	Flat, O–3 U–3.	p. 594 f. 105, A	Mule Creek Cave	P III ?
PM 97395	"	1/16	2-ply	Natural	Flat, O–3 U–3. 13 strands.	p. 594 f. 105, A	"	"
PM 33–62–10/2013	Fragment		"	"	Flat, O–2 U–2.	p. 593 f. 105, D	Floating House	BM—P II
USNM–X (Hough, 1914: 76, fig. 159)	Fragments		"	"	Square, 8-strand. Knot at bottom and cotton-wrapped fiber ring above this.	pp. 597, 602	Bear Creek Cave	P III
USNM 312259	2 Fragments Inc. Inc.	Inc. 1	"	"	Flat, O–2 U–2.	p. 593 f. 105, D	Navaho National Monument	P III ?
Cosgrove, 1947: 75	Fragment(s?)			Red	Flat, O–2 U–2.	p. 594	Mule Creek Cave	P III ?
Haury, 1934: 83	"			Natural	4-strand flat braid.	p. 593	Canyon Creek	P IV
Ibid., 83, fig. 16, a	"			2 brown strands 2 black strands	4-strand flat braid.	"	"	"
See also:								
ASM 20501					Blanket, corner braids. *Chart 15.*	—	Hidden House	P III
ASM 25982					Apron band. *Chart 18.*	—	Northern Arizona	P III ?
BM 03.250–1					Braided shirt. *Chart 16.*	—	White House	P III
PM A3188?					Cradle band made of flat braid. *Chart 20.*	—	Northern Arizona	P III ?
UM 29.43.182					Blanket. 6-strand square corner braids. *Chart 15.*	—	Lake Canyon	"
UM 29.43.183					Blanket. Square corner braids. *Chart 15.*	—	"	"
Haury, 1934: 89, pl. LIX					Blanket. Round corner braids. *Chart 15.*	—	Canyon Creek	P IV
Haury, 1945 *b*: 28–30, pls. 10, 11					Blanket. Round corner braids. *Chart 15.*	—	Painted Cave	P III
Ibid., 34–37, pl. 14, a					Cradle band made of flat wool braid sewed with cotton thread. *Chart 20.*	—	"	"

CHART 13

TWINE-PLAITING

Cat. No. or Ref.	Material	Description	Fig. and Page	Provenience	Period
ASM 13400	2-ply white cotton	Shirt, 26″×26″. *Chart 16.*	—	Tonto	P IV
NPS–T 9/592	"	Fragment.	p. 603	"	"
PM 97396	"	Incomplete, 11″×1″.	p. 603	Mule Creek Cave	P III?

CHART 14

CORDAGE

Cat. No. or Ref.	Material	Description	Fig. and Page	Provenience	Period
MNA 695/NA2519.287	2-ply white cotton.	Spirally-wrapped cord.	p. 605 f. 96, B	Kiet Siel	P III
NPS–MC 47	Soft black and white cotton strings.	Two cords made of 6 black strings wrapped with white string at intervals of an inch or so. Length, incomplete, 53″.	p. 605 f. 96, C; 114, L, 4	Montezuma Castle	P III–IV

CHART 15

BLANKETS

Cat. No. or Ref.	Dimensions		Description	Fig. and Page	Provenience	Period
	W.s.	w.s.				
AMNH no no.	41½ Com.	35¾ Inc.	White. *TC*, 27 squ. *S*, W & w 2 3-ply thrs. Worn, darned with twine-stitch.	p. 605	Verde Valley	P III–IV?
AMNH H/15982	55½ Com.	24 Inc.	White Ws & some ws, other ws red & brown. 3 thr. diamond twill tapestry, interlocking wefts.	pp. 547, 562, 628 f. 62, B; 64; 137, L	Grand Gulch	P III
ASM V–4	Inc.	Inc.	White. *TC*, 20 W, 18 w. *S*, W & w 2 3-ply thrs. Wrapped around mummy.	p. 605	Camp Verde	P III–IV?
ASM 484	42 Inc.	4¾ Inc.	Plain weave, painted. *Chart 9, b.*	p. 571	Little Kiet Siel	P III?
ASM 1107	21 Inc.	33½ Com.	White. *TC*, 31 W, 25 w. *S*, W 2 2-ply thrs. reinforced by twine-stitch and overcast; w 2 3-ply thrs. reinforced by twine-stitch. Close, even weave.	p. 577 f. 94, D	"	"
ASM 2067	42 Inc.	56 Inc.	White. *TC*, 30 W, 26 w. *S*, W 2 4-ply thrs., w 2 3-ply thrs. Worn, patched. Wrapped around mummy.	p. 605 f. 90, L	Gourd Cave	P III
ASM 13339 (2 blankets)	56 Com.	37½ Inc.	White. *TC*, 24 squ. *S*, W 2 3-ply thrs.	p. 605	Tonto	P IV
	Inc.	Inc.	White. *TC*, 24 W, 22 w. *S*, W & w 2 4-ply thrs. Both blankets wrapped around mummy of infant.			
ASM 18543 (2 blankets)	Inc.	Inc.	White. *TC*, 16 W, 15 w. 1 blanket thick, soft, no patching or darning.	p. 605 f. 6, B, 2	Vandal Cave	P III

CHART 15 (*Continued*)

Cat. No. or Ref.	Dimensions W.s.	Dimensions w.s.	Description	Fig. and Page	Provenience	Period
ASM 18544 (2 blankets)	22 Inc.	43½ Inc.	White. *TC*, 22 W, 20 w. *S*, W 2 4-ply thrs., w 2 3-ply thrs. Outer mantle. Patched, darned with heavy 2-ply cotton. Torn edge folded, hemmed.	p. 605	Vandal Cave	P III
	Inc.	Inc.	White. *TC*, 20 W, 18 w. *S*, W 2 3-ply thrs., w 2 2-ply thrs. Very soft, unworn. Looks newly woven.			
ASM 18545	34 Com.	38 Com.	White. *TC*, 20 squ. *S*, W 2 thick 3-ply thrs., w 2 5-ply S-twist thrs. Unworn blanket, folded like envelope over child mummy, which was first wrapped in feather blanket.	p. 605 f. 113, B	"	"
ASM 20501	23 Com.	40½ Com.	White. *TC*, 24 W, 21 w. *S*, W & w 2 4-ply thrs., each composed of 2 2-ply thrs. twisted together. Braid at each blanket corner.	p. 605	Hidden House	P III
ASM 20511	58 Com.	64 Com.	White, painted with black design resembling Kayenta B/W pottery. *TC*, 29 W, 24 w.	pp. 571, 605, 628, 635 f. 87; 138, M	"	"
ASM VC B#11	46 Inc.	49 Com.	White. *TC*, 22 squ. *S*, W & w 2 4-ply thrs.	p. 605	Ventana Cave	1000–1400
ASM VC B#22 (2 cloths)	48 Com.	15 Com.	White. *TC*, 24 squ. *S*, W 2 2-ply thrs., w 2 3-ply thrs.	p. 605 f. 88; 113, A	"	"
	45 Inc.	15 Com.	Red. *TC*, 22? W, 24 w. *S*, w 2 3-ply thrs. Red and white cloths sewed together along weft selvage. Both darned with twine-stitch.			
ASM VC B#22	80½ Com.	29 Inc.	White. *TC*, 38 W, 32 w. *S*, W 2 4-ply thrs. Very worn, held together by rows of twine-stitch in 2-ply tan thr.	p. 605	"	"
ASM VC B#22	40 Inc.	27⅝ Com.	Plain weave, checked. *Chart 3, a, b.*	—	"	"
ASM ?0–469			White. Wrapped around mummy.	p. 605	McEuen Cave	?
NPS–AM 954 & 4000 (1 cloth)	20⅜ Com.?	32½ Com.?	White Ws & some ws, other ws red & black. Anasazi-stripe twill. Slit at 1 warp edge, possibly a poncho.	pp. 540, 562, 605, 608 f. 54, B	Aztec Monument	P III
UM 29.43.182	33 Com.	21 Inc.?	White. *TC*, 20 W, 23 w. *S*, W & w 2 3-ply thrs. 6 6-ply cords form square braid at 1 corner.	p. 605	Lake Canyon	P III ?
UM 29.43.183	44 Com.	51¼ Com.	Brown tie-dye. *TC*, 32 W, 24 w. *S*, W 2 4-ply thrs., w 2 3-ply thrs. Square braid at each corner. *Chart 9, a.*	pp. 568, 579, 605 f. 83; 95	"	"
Haury, 1934: 89, pl. LIX	39 Com.	50 Com.	White. Round braided corner tassels.	p. 605	Canyon Creek	P IV
Haury, 1945*b*: 28–30, pls. 10, 11	54 Com.	53 Com.	White, painted in red, green, black. *TC*, 25 W, 20 w. *S*, W & w 2 3-ply thrs. Round braids, 3" long at corners. *Chart 9, b.*	pp. 571, 605, 628 f. 86; 137, K	Painted Cave	P III
Ibid., pl. 12	"	"	White, painted. Colors faded, 1 appears to have been red. *Chart 9, b.*	p. 571, 605	"	"
Ibid., p. 75			Blanket fragment. Solid black background bordered with red. *Chart 9, b.*	p. 570	Montezuma Castle	P III–IV

CHART 16

PONCHOS AND SHIRTS

Cat. No. or Ref.	Description	Fig. and Page	Provenience	Period
ASM–VC B#22	*Poncho.* For child. Gauze weave with weft-wrap open-work medallion on chest. Warp stretch, 28″, weft stretch, $8\frac{5}{8}$″. *Chart 4.*		Ventana Cave	1000–1400
ASM 13400	*Shirt.* Twine-plaited, 26″×26″. 2-ply white cotton. Sleeveless. *Chart 13.*	pp. 603, 607, 628 f. 99, B; 111; 112, A–D; 113, G; 139, K	Tonto	P IV
BM 03.250–1	*Shirt.* Braided, with sleeves, 30″ long without fringe. 20″ across shoulders. 2-ply white cotton.	pp. 597, 607 f. 108; 109; 113, H	White House	P III
PM A5614 (Guernsey, 1931: 102 & pl. 63)	*Shirt.* Plain weave made of 4 rectangular cloths. 2 cloths 16″ square sewed together to make body of shirt. 2 cloths, 13″×15″, sewed on as sleeves. Body cloths decorated by negative painting in brown. Sleeves painted yellow. 24 warps, 22 wefts per inch.	pp. 570, 607, 627 f. 113, F	Poncho House	P III
Haury, 1945*b*: 30–34, pl. 12	*Poncho* or sleeveless shirt. Made of 2 rectangular cloths sewed along upper warp selvages & with slits for head. Painted green, black & brown. Pompoms at lower corners. Simple tassels at shoulder corners. Warp stretch, $32\frac{1}{2}$″, weft stretch 33″.	pp. 570, 579, 607 f. 84; 113, F	Painted Cave	P III
Haury, 1945*b*: 33, pl. 13*a*	*Poncho* made of a single brown plain weave cloth, 26″ square. Slit from center to one warp selvage woven into cloth. Found on male infant. Square count 24.	p. 608 f. 113, D	"	"

CHART 17

Breech Cloths

Cat. No. or Reference	Dimensions		Thread count		Material (all cotton) Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch (folded)	weft stretch at waist (com.)	warp	weft		warp	weft				
AMNH 14/226	Inc. 24	6⅛	36	22	Natural		2 3-ply threads	Plain weave. Folded and sewed on self. Narrows to 3½".	p. 609	Verde Valley	? P III–IV
AMNH 29.1/7709	Inc. 7¼	5¼	28	20	"			Plain weave. Cloth folded and sewed on self with twined stitching. Cotton string fringe at bottom.	p. 610	White House	P III
AMNH 29.1/7710	Inc. 7½	5½	22	20	"	5-ply edge cord	2 3-ply threads	O–2 U–1 reversed twill and plain weave. Probably not loom-joined. Warps form fringe at bottom. *Chart 8, a.*	pp. 539, 562, 613 f. 116, B	"	"
AMNH 29.1/7935	Com. 8¾	4¼	22	16	"	2 2-ply threads	2 2-ply threads 2 4-ply threads	Plain weave. ½" band of O–2 U–2 plain weave just above fringe. Warp ends form fringe at bottom. Probably not loom-joined(?).	p. 610 f. 114, C; 116, A	"	"
ASM V–1	Inc.	5¼	32	28	"			Like ASM #16231.	p. 609 f. 114, B	Camp Verde	? P III–IV
ASM 2983	Com. 6⅜	5½	18	16–26	Natural warps, and some wefts. Some blue and brown wefts.		2 3-ply threads	Double-weft twill. Not loom-joined. Warp ends form fringe at bottom. *Chart 8, a.*	pp. 555, 562, 612 f. 75; 115, B	Gourd Cave	P III
ASM 16231	Inc. 24	5⅜	34	24	Natural		2 4-ply threads, very fine	Plain weave. Folded and stitched on self. Keeps full width throughout its length.	p. 609 f. 114, B	Camp Verde	? P III–IV
ASM 16855	Inc. 67½	8¼	25	20	"	2 2-ply threads	2 3-ply threads	Plain weave. Narrows to strip ⅜" wide. Loom-joined.	p. 609 f. 114, A	Unknown	?
ASM 20498	Inc. 13	6	32	24	"		"	Plain weave. Folded and sewed on self. Not loom-joined.	p. 609	Hidden House	P III
BM 03.250–6	Inc. 10½	5½	18	20	Natural warps and wefts and some black wefts.	2 2-ply threads	Finished edges, no selvage threads.	Brocaded weft-float and plain weave tapestry. Probably breech cloth. *Chart 8, b*	pp. 560, 562, 613, 628 f. 76, B; 79; 80; 137, H	White House	P III
CSHS 01461	Inc. 8½	6½	27	46	Natural warps. Natural, red and brown wefts.	2 2-ply threads	2 3-ply threads	O–2 U–1 reversed twill. Anasazi stripe. *Chart 8, a.*	—	Mesa Verde	P III

CHART 17 *Continued*

Cat. No. or Reference	Dimensions		Thread count		Material (all cotton) Color	Selvages		Remarks and description	Fig. and Page	Provenience	Period
	warp stretch (folded)	weft stretch at waist (com.)	warp	weft		warp	weft				
MNA 77/NA405.M227	Inc. $24\frac{1}{2}$	$5\frac{3}{16}$	27	20	Natural		2 2-ply threads	Plain weave. Loom-joined. Narrows to strip 1″ wide.	p. 609 f. 115, A	Wupatki	P III
MNA 561/739.2	Inc. $12\frac{3}{4}$	$8\frac{1}{4}$	26	21	"		2 2-ply threads	Plain weave. Loom-joined. Warp rep belt $\frac{5}{8}$″ wide.	p. 609	Walnut Canyon	P III
NPS–T 9/263	Inc. 12	$7\frac{1}{4}$	30	24	"	2 2-ply threads	"	Plain weave. Loom-joined.	p. 609	Tonto	"
NPS–T 9/401	Fragment				"		"	"	p. 609	"	"
NPS–T 9/407	"				"		"	"	p. 609	"	"
NPS–T 9/408	"				"		"	"	p. 609	"	"
NPS–T 9/483	Inc. $11\frac{3}{4}$	$6\frac{3}{8}$	24	22–34	Natural warps and wefts, and some blue and brown wefts.		"	Twill tapestry with interlocking wefts. Loom-joined. *Chart 8, a.*	pp. 555, 563, 609 f. 76, A; 138, I	"	"
NPS–T 9/675	Fragment				Natural			Plain weave. Loom-joined.	p. 609	"	"
PM 33–62–10/2006	Inc. $8\frac{1}{4}$	$3\frac{3}{4}$	22	24	"		2 2-ply threads	Plain weave. Folded and sewed on self. Probably breech cloth. May have had painted designs on front.	p. 613	Floating House	BM–P II
USNM 250178	Inc. $10\frac{3}{8}$	$4\frac{1}{2}$	20	20	"	2 2-ply	"	Plain weave. Folded and sewed on self with running-stitch. 3 extra strings appliquéd to front of cloth. Fringe of cotton strings at bottom.	pp. 573, 613 f. 116, C	Unknown	?
UU 1219	Inc. 7	$5\frac{1}{2}$	23	21	"		"	Plain weave. Folded and sewed on self.	p. 610	Bat Woman House	P III

CHART 18

COTTON OR PART-COTTON APRONS, WOVEN WAIST BAND, FREE-HANGING FRINGE

Cat. No. or Ref.	Description	Fig. and Page	Provenience	Period
AMNH 29.1/7569	*M*, 9-ply & 2-ply white cotton. 9-ply cord doubled to form 2 foundation "warps." 2-ply strings woven over these & twisted to form fringe. Waist band, inc. 11½". Fringe, inc. 9".	p. 615 f. 118, B	White House	P III
ASM 13339	*M*, 1-ply white cotton Ws, yellowish ws. White "warp" threads form 2 bundles, each of 13 thrs. Over these paired yellowish ws are woven so as to form a fringe 5" long. The skirt band is folded at its center, passed about child's waist & fastened at right hip.	p. 615 f. 118, E	Tonto	P IV
ASM 25982	*M*, 2-ply white & brown cotton. 10 "warps," each a bundle of 3 thrs. 2-ply brown & white ws woven in slit tapestry technique. Separate thrs. twisted together in 6" fringe. This fringed band is about 9" long. Fastened to narrow braid 11" long. *Chart 6.*	pp. 526, 613 f. 114, D; 118, D; 119; 137, E	Northern Arizona	?
MNA 695/NA2519.759	*M*, 2-ply white & L Br cotton. Slit & interlocking tapestry band from 1 edge of which a fringe of 2-ply cotton thrs. hangs down. These thrs. twisted in groups of 4. Longest fringe cord, 8⅜". Band 1¼" wide; length inc. 13 warps & 50 wefts per inch. *Chart 6.*	pp. 526, 613 f. 117; 137, D	Kiet Siel	P III
NPS-MC 41	*M*, 2-ply cotton. Waist band, ¾"×9¾" (inc.). Length of fringe (inc.) 9". Waist band consists of 14-strand cord doubled to make 2 warps. Wefts woven over this & extended into fringe.	p. 615	Montezuma Castle	P III–IV
Haury, 1945*b*: 39–40, pl. 15, *a*, fig. 10	*M*, 2-ply yucca string warps, cotton wefts. Waist band, 1½"×15". Fringe (inc.) 9". Waist band consists of 6 yucca strings doubled to make 12 warps. Wefts woven over paired warps & extended into fringe.	p. 615 f. 118, A; 120	Painted Cave	P III

CHART 19

STRING SKIRTS, APRONS AND CLOUTS CONTAINING COTTON

Cat. No. or Ref.	Description	Fig. and Page	Provenience	Period
PM 97414	Clout or apron. Skein of cotton threads knotted around bunches of apocynum fiber strings. 5"×8–10", inc. Waist cord consists of 11 8-strand cotton strings.	p. 616 f. 118, C, 1	Mule Creek Cave	P III ?
USNM 246444	2 breech clouts. Each consists of a skein of cotton string, folded & knotted at one end. 21½" & 17¾" long, respectively.	p. 617	Head of Tularosa Canyon	?
USNM 252209	Apron. Cotton cloth strips used as foundation "warps" of waist band. Fiber threads woven over these & hang down as fringe. Orange-colored.	p. 616	Unknown	?
Cosgrove, 1947: 68–69	Clout or apron. Single-ply cotton threads bound at their centers by 5 wraps of 8-strand cotton cord. 4½"×9", inc. 2 waist cords of 8-strand cotton string pass beneath wrapping.	p. 616 f. 118, C, 2	Mule Creek Cave	P III ?
Haury, 1934: 63, pl. XL	Skirts. Cotton cloth strips used as foundation "warps" of waist band. Fiber string fringes.	p. 616	Canyon Creek	P IV
Haury *et al.*, 1950: 429	Breech clout. Strips of cotton cloth torn from blanket, tucked under belt at front & rear. Belt is part of net. Male burial.	p. 617	Ventana Cave	1000–1400
	String clouts on female mummies. Some contain cotton strings.	p. 617	"	"

CHART 20

Cradle Bands

Cat. No. or Ref.	Description	Fig. and Page	Provenience	Period
AMNH no no.	Plain weave white cloth sewed over 2 small sticks.	p. 621	Grand Gulch	P III ?
ASM 2775	All cotton plain weave tapestry band woven between 2 sticks. $4\frac{3}{4}''\times13\frac{3}{8}''$. *Chart 6.*	pp. 524, 621 f. 46; 123, N; 137, C	Nitsie Canyon (Small ruin near Inscription House)	BM III P I ?
ASM 3446	All cotton plain weave tapestry band. $3\frac{3}{8}''$ wide, length incomplete. *Chart 6.*	pp. 524, 621	Gourd Cave	P III
PM A3188 ?	Flat O–2 U–2 white cotton braid $3\frac{1}{4}''$ wide. Ends cut & sewed over small sticks. Length $13\frac{3}{4}''$. *Chart 12.*	p. 621	Northern Arizona	?
PM 3196	Plain weave tapestry band; yucca? warps, cotton wefts. $5\frac{3}{4}''$ wide. Length incomplete. *Chart 6.*	pp. 524, 621 f. 47, B; 137, M	"	"
UC 2404	Doubled piece of plain weave white cotton cloth sewed to 2 small sticks. $3''\times11\frac{3}{4}''$.	p. 621	Canyon del Muerto	P III
USNM 156276	Ali cotton plain weave tapestry band. $4\frac{1}{2}''\times16\frac{1}{8}''$. *Chart 6.*	pp. 524, 621 f. 47, C; 138, F	Palatki	P IV
Haury, 1934: 98 & pl. LXI	Fragment of brown & white brocaded cloth attached to a small stick & found with an infant burial. *Chart 5, b.*	—	Canyon Creek	P IV
Haury, 1945*b*: 34–37, pl. 14, *a*	Brown and white plaid wool braid, sewed to small sticks with cotton thread. $3''\times17''$. *Chart 12.*	pp. 601, 621 f. 110	Painted Cave	BM or P III

CHART 21

BAGS

Cat. No. or Reference	Dimensions		Thread count		Material (all cotton) Color	Selvages		Description	Fig. and Page	Provenience	Period
	Length (from bottom to mouth of bag)	Width (from one edge of bag to the other)	warp	weft		warp	weft				
AMNH H/12260	Inc.	1			Single-ply Natural			Flat braid, folded lengthwise and sewed to make small bag 1″ wide. *Chart 12*	p. 623	Grand Gulch	? P III
AMNH H/13469	Com. 4	3½	24	18	Single-ply. Natural			Plain weave cloth. Seams turned in and overcast.	p. 621	Grand Gulch	"
AMNH H/14400	Com. 13¼	13¼	22		Single-ply. Natural and some black wefts			O–2 U–1 reversed twill tapestry. Brocaded weft-float pattern in black at center of cloth. Bag is square of cloth with ends gathered and sewed to a piece of braid. *Chart 8, a.*	pp. 560, 562, 617, 623, 629, 631 f. 97, A	"	"
AMNH 14/228	Com. 5½	3			Single-ply. Natural warps and plain weave wefts. Brown brocade wefts			Brocaded cloth. Overcast seams. *Chart 5, b.*	—	Verde Valley	? P III–IV
ASM 1983	Com. 3½	1¾			3-ply. Natural			Closed loop medicine bag. Contains small stones of various sorts. *Chart 11, a.*	—	Gourd Cave	P III
ASM 2005	Inc. 6¾	5¼	26	22	Single-ply. Natural			Plain weave cloth. Warps run with length of bag. Fold at bottom. Raw edges at mouth of bag are tightly overcast. Sides turned in and overcast on the inside. Drawstring at mouth is 2 3-ply threads twisted into cord. Contains thread, stone, root.	p. 624	"	"
ASM 3017	Inc. 4	¾			2-ply. Natural			Closed loop. May be part of a bag. Not definitely identifiable. *Chart 11, a.*	—	"	"
ASM 16144	Inc. 3½	2	30	28	Single-ply. Natural			Plain weave cloth. Fold parallels warps. Sewing in coarse, un-spun yucca(?) fibers. Called "medicine pouch of cotton cloth with feathers in it."	p. 624	Zele Cave	? P III
ASM 20494	Inc. 23	8	25	19	"	2 3-ply threads		Plain weave cloth folded at center to bring two warp edges together for side seam. Stitching is simple running-stitches about ¼″ long, 1″ in from edge, thread is 2-ply yucca(?).	p. 621 f. 123, B	Hidden House	P III
ASM 20506	Inc. 4½	7	31	16	"	2 4-ply threads	2 4-ply threads	Plain weave cloth folded at center, two weft edges joined to make one side of bag. Bottom of bag is warp selvage sewed on self. Both seams are overcast. Loosely-twisted 4-ply sewing thread.	p. 621	"	"
CSHS 01462 (W. I, no. 4)	Inc. 6¼	2½	27	27	"			Plain weave cloth. Seams overcast with yucca(?) thread.	p. 621	Mesa Verde	"
CSHS 01463 (W. I, no. 14)	Com. 5	2⅜	24	20	"		2 3-ply threads	Plain weave cloth. Bag is really narrow band 2¼″ wide, folded across and sewed up sides with overcast stitch.	"	"	"
CSHS 01464	Inc. 5	3⅜			"		2 4-ply	Plain weave cloth. Edges turned in and overcast with 2-ply yucca(?) thread. Yucca(?) drawstring at mouth.	"	"	"
GP 113	Com. 5⅞		30	30	"			Plain weave cloth. Bound with 2-ply yucca cord. Contained squash seed and small piece malachite.	p. 625	McEuen Cave	?

CHART 21 *Continued*

Cat. No. or Reference	Dimensions		Thread count		Material (all cotton) Color	Selvages		Description	Fig. and Page	Provenience	Period
	Length (from bottom to mouth of bag)	Width (from one edge of bag to the other)	warp	weft		warp	weft				
NMSM—no number					Single-ply. Natural			Small square of plain weave cloth folded and tied to make small bag.	p. 621 f. 97, B; 123, F.	Frijoles Canyon	P IV
NPS–MC 18	Com. 12½ (folded)	Com. 5¾ (not folded)	40	28	Single-ply. Warps and some wefts natural, most wefts dyed black	?	?	Weft-float pattern weave. Paired wefts. One cloth, 25″ long, was folded at center and sewed up sides with running-stitch. *Chart 8, b.*	pp. 559, 563, 621, 635 f. 32, B; 77; 78; 139, H	Montezuma Castle	P III–IV
NPS–T 9/60, 9/61	Inc. 3½ 5¼	⅞ 1	29 28	22 22	Single-ply. Black			O–3 U–3 cylindrical twill sacks. *Chart 10, c.*	—	Tonto	P IV
NPS–T 9/62	Inc. 3½	¾	20	24	Warps, single-ply. Wefts, 2-ply. Black			O–2 U–2 cylindrical twill sack. *Chart 10, c.*	—	"	"
NPS–T 9/262	Inc. 14¼	9¾			Single-ply. Natural			Plain weave cloth. 2 pieces cut and sewed on 3 sides, with running and overcasting stitches. 3-ply and 5-ply cotton threads.	p. 621	"	"
PM A1562	Inc. 3¼	1¾	32	32	"			Plain weave cloth. Sewed with coarse yucca(?) thread.	"	Olla House	? P III
PM–A 1848, 1849, 1850 (Kidder & Guernsey, 1919: 147–150, pl. 62)	Com. *ca.* 5	Com. 2			2-ply white warps, black wefts			Cylindrical twill sacks. "Medicine bags," contained seeds, stones, paint, herbs, shell beads. *Chart 10, c*	—	Sunflower Cave, Marsh Pass	P III
UM 29.43.118	Inc. 6½	3	20	20	Single-ply. Natural			Plain weave cloth, cut and sewed to form knife case. Overcast seams. Possibly rubbed with red paint.	p. 621 f. 125	Southwestern Colorado	? P III
UM 29.43.153	Com. 8¼	3¼	37	32–40	Single-ply. Natural warps and some wefts—also red and brown wefts	2 4-ply threads	2 2-ply threads	O–2 U–2 reversed twill. Sewed with yucca thread, seams turned inside. *Chart 8, a.*	pp. 540, 563, 621 f. 54, B; 57; 123, D	"	"
UM 29.43.154	Inc. 5⅜	2⅜	32	27	Single-ply. Natural			Plain weave cloth. Cotton string balls *ca.* ⅜″ in diameter fastened to surface. Seams turned inside.	p. 621	"	"
UM 29.43.155	Com. 8½	3¼	24	24	Single-ply. Yellow-brown	2 2-ply threads	2 2-ply threads	Plain weave cloth. Long strip with 2 weft selvages, folded at center and sewed up sides with running-stitch. Seams turned in. "Medicine pouches" found in bag.	p. 624	"	"
USNM 147960			33	33	"			Plain weave cloth. Small square folded and tied with yucca(?) cord to make container.	p. 621 f. 97, B	"Salt River"	? P III–IV
USNM 270244					Cotton cord. Natural			Closed loop bags. Number not recorded. Contained jade knife, feathers and prayer sticks. *Chart 11, a.*	—	Navaho National Monument	? P III
Bartlett, 1934: 46–47			23	30	Single-ply. Natural			Plain weave cloth. Small square folded and tied with yellow cotton cord to make container 2½″ in diameter.	p. 621 f. 97, B	San Francisco Mt. area	P II
Haury, 1934: pl. XLVIII								Plain weave cloth. Piece sewed up sides to form bag. Size not stated. Contained squash seeds.	pp. 570, 625	Canyon Creek	P IV
Ibid., 91–95, fig. 19, pl. LX, *a*								Weft-warp openwork bag. *Chart 4.*	—	"	"
Ibid., 99								Plain weave. Painted band, red, at edge of bag. *Chart 9, B.*	p. 621	"	"

CHART 22

MISCELLANEOUS COMPLETE ARTICLES

Cat. No. or Ref.	Description	Fig. and Page	Provenience	Period
AMNH 29.1/7994	*Tump line or sling.* 2-ply white cotton string. Flat braided center. Rope-like ends made by braiding around a core. 102″ long. *Chart 12.*	p. 597 f. 107; 123, P	White House	P III
ASM 1031	*Sandal.* Wickerwork weave. 2-ply yucca? warps, cotton rag strip wefts.	p. 618 f. 114, K	Betatakin	"
ASM 2705	*Sandal tie.* Cotton rag strips.	p. 618	Gourd Cave	"
ASM 2744	*Sandal.* Wickerwork weave. Cotton rag strip wefts at ball of foot. 2-ply yucca? warps.	p. 618	"	"
ASM 2767	*Sandal.* Wickerwork weave. 2-ply yucca? warps. Cotton rag strip wefts.	p. 618	"	"
ASM 20491	*Quiver.* Plain and slit tapestry weave. Single-ply cotton. White warps. White, blue and brown wefts. 31¾″ long.	pp. 520, 532, 625 f. 39; 40; 41; 123, A; 126, A; 138, H, K	Hidden House	"
ASM 20492	*Quiver.* O-3 U-3 irregular twill tapestry with interlocking wefts. Single-ply cotton. White warps. White, brown, black wefts. Closed loop "toe" of 2-ply cotton string. 13⅜″ long, incomplete.	pp. 555, 562, 589, 625 f. 72; 73; 74; 90, F; 138, L	"	"
ASM 20493	*Kilt.* Plain weave cloth with plain weave tapestry insets. Single-ply cotton. White warps. White, blue, black wefts in tapestry. 36¾″×15¼″ complete.	pp. 522, 609, 628 f. 42, B; 43; 114, N	"	"
ASM 20496	*Turban.* Twisted hanks of cotton yarn. Single-ply; white, brown, red.	p. 619 f. 114, I; 122	"	"
ASM 23492	*Crescent-shaped object.* Plain tapestry weave. Length, 8″. Use unknown, May be front section of woman's apron. 2-ply yucca? warps, 2-ply white cotton wefts.	p. 526 f. 48; 114, H	Unknown, probably Northern Arizona	?
NPS-T R-3	*Sandal insole?* Complete rag-weft pad, 7⅛″×2¾″.	pp. 499, 618 f. 114, J	Tonto	P IV
PM A1313	*Sandal tie.* Cotton rag strips.	p. 618	Monument Valley, Ruin #4	P III
PM A5057	*Sleeve-like object.* Plain weave white cotton, incomplete length, 10″.	pp. 576, 607 f. 126, C	Tsegi Canyon, Cave #1, Middle Branch, Grave 1, B. 2	P I
PM 97397 (Cosgrove, 1947: 69, fig. 79, *a*)	*Sleeve or small quiver.* Plain weave white cloth, narrowed at one end, with some O-2 U-2 plain weave at that end. Complete warp stretch, 10½″. Weft stretch, folded, 4¼″.	pp. 607, 625 f. 114, G; 126, B	Mule Creek Cave	P III ?
UM 29.43.181	*Sash.* Plain weave white cloth with 8 narrow bands of brown wefts near center. Complete, 97½″×8″.	pp. 491, 619 f. 12; 114, P	Lake Canyon	"

CHART 23

WRAPPINGS ON PRAYER STICKS, CANE CIGARETS AND OTHER CEREMONIAL OBJECTS

Cat. No. or Ref.	Description	Fig. and Page	Provenience	Period
ASM 3089	Rectangular cloth made like cigaret sash. Weft stretch, com. 8″, warp stretch, com. $5\frac{3}{8}$″.	p. 619 f. 121	Bat Cave, Catalina Mts.	?
MNA 554/2716	3 cane cigarets wrapped with plain weave sashes especially constructed for the purpose. 1 small sash: *TC*, 21 W, 15 w to $\frac{7}{8}$″. $\frac{7}{8}$″×2″. 1 large sash: 3″×$3\frac{3}{4}$″.	p. 620 f. 124, E	Hieroglyphic Pass, Cave	P IV ?
MNA NPS/NA405 R7B27	Weft stretch, inc. 7″; warp stretch, com. 3″. *TC*, 19 W, 18 w. Wh W, Wh Bl w. 1-ply cotton. *S*, W 2-ply thrs., w finished edge. Twill weave. Pattern: 2 Bl. weft stripes, 3 white.	p. 620 f. 124, F	Wupatki	P III
MNA 695/NA2519.261	Plain weave cloth fragments wrapped around corn husk & tied with 2-ply black cotton string.	p. 621 f. 124, B	Kiet Siel	"
MNA no number	String-wrapped prayer stick.	p. 619 f. 123, L; 124, A	Kiet Siel ?	P III ?
Private Collection, Phoenix, Arizona	Cane cigarets with plain weave white cloth sashes. 1 embroidered sash, Br Blu thrs., double running-stitch. *Chart 5, a.*	—	Olberg, cave near	P IV ?
Cosgrove, 1947: 126, fig. 119	String-wrapped prayer sticks.	p. 619 f. 124, D	Mule Creek Cave	P III ?
Fulton, 1941: 23–24, pls. VI, VII	String-wrapped cane cigarets. Paired sherd disks bound with cotton string.	pp. 619, 621 f. 123, M; 124, C, D	Winchester Cave	P IV ?
Haury, 1934: pl. LXIX	Bundle of rushes wrapped with Br Y Bl string.	p. 621 f. 123, I	Canyon Creek	P IV
Haury, 1945*a*: 202, pls. 87–88, 89–90	Cane cigarets with sashes of plain weave white cloth, *ca.* $\frac{1}{2}$ to $\frac{3}{4}$″×2″. 1 is 2/2 rev. twill, Blu ws; $\frac{7}{8}$″×$2\frac{1}{2}$″.	p. 619 f. 124, G	Double Butte Cave	P IV ?
Hough, 1914: 80, fig. 167	Cane cigaret with plain weave white cotton sash.	p. 621	Phoenix, cave near	"
Hough, 1914: 107–111	Cane cigarets with plain weave white cloth sashes.	p. 621	Upper Gila	P III ?
Martin *et al.*, 1952: 351–354	Cane cigarets with cotton string wrappings.	p. 619	Tularosa Cave	700–1100

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